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Who Adopts Crypto Assets in Japan? Evidence from the 2019 Financial Literacy Survey

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Abstract

The adoption of crypto assets has been of great concern to policymakers ever since Facebook announced its proposed cryptocurrency, Libra, in mid-2019. Behind this concern lies the possibility of widespread Libra adoption for day-to-day transactions, bringing with it a set of serious risks related to money laundering, illicit financing, and consumer and investor protection. This study aims to investigate the demographic characteristics, financial literacy, financial behavior, three risky asset holdings, and the use of noncash payment methods among Japanese crypto asset adopters. To achieve these aims, probit models and multinomial logit models are applied. We find that Japanese crypto asset owners are more likely to be young and male and to have lower educational levels than non-owners. This is consistent with previous studies. The average relationship between crypto asset ownership and level of objective financial literacy is not found to be statistically significant; however, crypto asset owners' degree of understanding of crypto assets is associated with their level of objective financial literacy. Owners who indicate that they understand crypto assets to some extent tend to have better objective financial literacy, while owners who indicate that they do not understand crypto assets tend to have a lower level of objective financial literacy. A better understanding of crypto assets is also positively associated with earning profits from investing in them; however, objective financial literacy is not related to profiting from investment in crypto assets. Our results suggest that, in predicting the performance of an investment in crypto assets, specific knowledge of crypto assets is more important than objective financial literacy that captures general financial knowledge. Other notable findings of the study include the fact that crypto asset owners obtain information about economy and finance from mass media more frequently; that they are more experienced with financial troubles, such as bank transfer fraud or multiple debts; and that they are less credit card literate than non-owners, on average. They tend also to be more myopic, subject to herding, lacking in self-control, over-confident in their financial literacy, and less loss-averse than non-owners. Crypto asset owners' demographic characteristics are similar to those of the individuals who have experience investing in stocks, investment trusts, and foreign currency denominated money market funds. They are also demographically similar to those who use both crypto assets and one of the four payment methods—credit cards, electronic money, debit cards, and mobile payments via smartphones—rather than crypto assets alone.

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The adoption of crypto assets has been of great concern to policymakers ever since Facebook announced its proposed cryptocurrency, Libra, in mid-2019. Behind this concern lies the possibility of widespread Libra adoption for day-to-day transactions, bringing with it a set of serious risks related to money laundering, illicit financing, and consumer and investor protection. This study aims to investigate the demographic characteristics, financial literacy, financial behavior, three risky asset holdings, and the use of noncash payment methods among Japanese crypto asset adopters. To achieve these aims, probit models and multinomial logit models are applied. We find that Japanese crypto asset owners are more likely to be young and male and to have lower educational levels than non-owners. This is consistent with previous studies. The average relationship between crypto asset ownership and level of objective financial literacy is not found to be statistically significant; however, crypto asset owners' degree of understanding of crypto assets is associated with their level of objective financial literacy. Owners who indicate that they understand crypto assets to some extent tend to have better objective financial literacy, while owners who indicate that they do not understand crypto assets tend to have a lower level of objective financial literacy. A better understanding of crypto assets is also positively associated with earning profits from investing in them; however, objective financial literacy is not related to profiting from investment in crypto assets. Our results suggest that, in predicting the performance of an investment in crypto assets, specific knowledge of crypto assets is more important than objective financial literacy that captures general financial knowledge. Other notable findings of the study include the fact that crypto asset owners obtain information about economy and finance from mass media more frequently; that they are more experienced with financial troubles, such as bank transfer fraud or multiple debts; and that they are less credit card literate than non-owners, on average. They tend also to be more myopic, subject to herding, lacking in self-control, over-confident in their financial literacy, and less loss-averse than non-owners. Crypto asset owners' demographic characteristics are similar to those of the individuals who have experience investing in stocks, investment trusts, and foreign currency denominated money market funds. They are also demographically similar to those who use both crypto assets and one of the four payment methods—credit cards, electronic money, debit cards, and mobile payments via smartphones—rather than crypto assets alone.

Keywords**:** *Crypto assets, financial literacy, payment methods*
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1. Introduction

The adoption of crypto assets has been a great concern for policymakers ever since Facebook announced its cryptocurrency, Libra, in June 2019. Behind this concern lies the possibility of widespread adoption of Libra for day-to-day transactions in emerging market economies—as a result of the anticipated stability of Libra's value, which is linked to a basket of major sovereign currencies (such as USD, EUR or GBP). The immediate reaction of G20 leaders to Libra being announced was a highly negative one and they pointed out a set of serious risks related to money laundering, illicit financing, and consumer and investor protection. Meanwhile, many central banks—including those linked with advanced economies, such as China, Canada, the UK, Japan, the EU, Sweden, and Switzerland—have begun to research the possible introduction of central bank digital currencies.

Before Libra was announced, both academic researchers and investors tended to view crypto assets as being primarily used for storing value rather than as a medium of exchange for day-to-day transactions. Previous academic studies on crypto assets, as surveyed in Halaburda et al. (2020) or Smith and Kumar (2018), have established the volatile price formation of crypto assets—especially Bitcoin. Along with Bitcoin's volatile price, its slow settlement time and high real costs of operating the system—especially the energy consumption required to power it—do not make it useful for day-to-day transactions, as noted by Mester (2020). Even when crypto assets are viewed as a storage of value, investors have experienced recurring asset losses as a result of hacking attacks on crypto asset exchange companies. Japanese examples include the hacking attacks on Bitpoint in 2019 and on Tech Bureau in 2018. When viewed as a means of day-to-day transactions, crypto assets can also lead to losses. In one Japanese example, the

2014 failure of a Bitcoin exchange—called Mt. Gox—prevented the use of crypto assets for day-to-day transactions.

However, after Libra was announced—and given the possibility of widespread adoption of this cryptocurrency for day-to-day transactions—the use of crypto assets should not only be examined for storing value purposes but also as everyday payment tools. To study the storing of value function of crypto assets, we should consider the effects of financial literacy on asset accumulation (see Lusardi and Mitchell, 2014, and Gomes et al., 2020, for surveys). For example, positive associations between stock market participation and level of financial knowledge, observed by van Rooij et al. (2011), have also been reported in Japan (for a recent example, see Gan et al., 2019). Would we obtain the same positive associations between crypto asset ownership and financial literacy? To study the demand for crypto assets for day-to-day transactions, we should also consider the relationship between the choice of payment methods and demographic characteristics, such as age, gender, and educational attainments. For example, Fujiki (2019) showed that credit card users who make day-to-day payments of over 10,000 yen (about 90 US dollars) tend to be young and female, as well as to have higher educational attainments, in comparison to cash-only users (see Stavins, 2017, for a survey outside Japan, and Fujiki, 2019, for evidence in Japan). Huynh et al. (2020) showed that improvements in welfare, resulting from the adoption of a central bank digital currency, vary depending on users' age and the differing degrees of users' education and income. Would we obtain similar associations between crypto asset ownership and demographic characteristics?

Despite legitimate policy concerns around crypto assets, the number of studies on the demographic characteristics of crypto asset owners is small (see Halaburda et al., 2020, section 4 for a survey). Notable exceptions are studies from the US (Schuh and Shy,

2016; Hundtofte et al., 2019), Canada (Henry et al., 2019a, 2019b, 2018), Austria (Stix, 2018). These studies showed that crypto asset owners are more likely to be young and male and to have lower educational levels than non-owners. Henry et al. (2019a) showed that Canadian crypto asset owners have a lower level of financial literacy, while Stix (2018) showed that Austrian crypto asset owners have higher levels of financial knowledge. Lammer et al. (2019) also found that European and US individuals who use a German online bank to invest in cryptocurrencies with structured retail products tend to be male, have a high monthly income, and are active traders who are prone to investment biases and hold risky portfolios. Kawamura et al. (2019) showed that Japanese investors—who have experience investing in one of the following financial assets: foreign exchange margin trading, equity margin trading, futures, options, and cryptocurrencies—tend to have a higher level of financial literacy and to be less loss-averse, less risk-averse, and over-confident (measured using the score obtained on the self-evaluation of one's financial literacy quiz and one's actual score) in their financial literacy. Globally, there are no studies that provide detailed information on financial literacy and financial behavior of crypto asset owners.

To address this gap in the literature, this study uses data from Japan's 2019 Financial Literacy Survey (FLS) in order to investigate—among Japanese adopters of crypto assets—the demographic characteristics (e.g., age, gender, income, financial asset holdings, occupation, and educational attainment); financial literacy; financial behavior from the perspective of behavioral economics (e.g., present-biased preferences, herding, loss aversion, and risk aversion, see Beshears et al., 2018, for literature on behavioral household finance); three risky asset holdings (stocks, investment trusts, and foreign currency denominated money market funds [MMFs]); and the adoption of noncash

payment methods. The study applies both probit models and multinomial logit models. First, we examine the differences in demographic factors between crypto asset owners and non-owners. Second, we examine the differences in demographic characteristics among crypto asset owners—according to their level of understanding of crypto assets, the profitability of their investment in crypto assets, their holdings of other risky assets, and their adoption of other noncash payment methods. This second analysis, which makes comparisons among crypto asset owners, was possible because the FLS contains a relatively large number of crypto asset owners (1,622 persons). Previous studies had only focused on comparisons between crypto asset owners and non-owners. The interesting results of our study are described in more detail below.

First, Japanese crypto asset owners are more likely to be young and male and to have lower educational levels than non-owners, on average. This is consistent with the findings in Schuh and Shy (2016), Henry et al. (2019a), and Stix (2018). They are also more likely to have experience investing in the other three types of risky assets than non-owners are, which is consistent with Stix (2018). Furthermore, our data provides the following notable findings. Regarding financial literacy, the average relationship between crypto asset ownership and objective financial literacy is not statistically significant. Crypto asset owners obtain information on economy and finance from mass media more frequently. They are more experienced with financial troubles, such as bank transfer fraud or multiple debts, and are less credit card literate than non-owners. Regarding their financial behavior, they tend to be myopic, subject to herding, lacking in self-control, over-confident in their financial literacy (measured by the difference between one's subjective financial literacy, defined as the self-evaluation of one's level of financial literacy in comparison with other people, and an actual score of one's financial literacy),

and less loss-averse than non-owners, on average. They are more likely to have their own favorite information sources on economy and finance.

Second—with respect to the heterogeneity of crypto asset owners in terms of their varying degrees of understanding about crypto assets—many of the results obtained for an average crypto asset owner are consistent with owners who understand crypto assets very well or who understand them to some extent, albeit there are some exceptions. For instance, owners who understand crypto assets very well are not loss-averse and this finding is consistent with that of Stix (2018). Owners who understand crypto assets very well are also relatively wealthy, not likely to be myopic, and not lacking in self-control more than non-owners. Owners who understand crypto assets to some extent have better objective financial literacy, which is also consistent with Stix (2018). They are not myopic, not subject to herding, and not lacking in self-control. However, the results of the average crypto asset owner are not consistent with those of owners who do not understand crypto assets so well or who do not understand them at all. The financial literacy of crypto asset owners especially varies depending on their understanding of crypto assets,—although the relationship between crypto asset ownership and level of objective financial literacy is not statistically significant, on average. Owners who understand crypto assets to some extent tend to have better objective financial literacy (consistent with Stix, 2018) and to be over-confident about their financial literacy. Meanwhile, owners who do not understand crypto assets at all tend to have lower financial literacy (consistent with Henry et al., 2019a) and not to be over-confident about their financial literacy.

Third—with respect to the heterogeneity of crypto asset owners in terms of the profitability of their investment in crypto assets—a better understanding of crypto assets is found to be positively associated with earning profits from investing in them. However,

objective financial literacy is not related to profiting from investment in crypto assets. While these results do not indicate a causal relationship, they suggest that specific knowledge about crypto assets is more important than general knowledge about finance for predicting the performance of an investment in crypto assets.

Fourth—with respect to the heterogeneity of crypto asset owners in terms of their risky asset holdings—most of the characteristics of the owners of stocks, investment trusts, and foreign currency denominated deposits and MMFs are similar to those of an average crypto asset owner, apart from the number of their financial asset holdings and their age. However, if we restrict our attention to those crypto asset owners who also hold some stocks, investment trusts, and foreign currency denominated deposits and MMFs, we find that they tend to be wealthy and experienced investors. In addition, they tend not to experience financial troubles, such as bank transfer fraud or multiple debts. They also tend not to be myopic, unlike crypto asset owners who do not own any of these other three types of risky assets.

Fifth—with respect to the characteristics of crypto asset owners in terms of the adoption of credit cards, electronic money, debit cards, and mobile payments via smartphones—most characteristics of an average crypto asset owner are found to be similar to the characteristics of those who use both crypto assets and one of the four payment methods (hereafter, *Both yes*), unlike those who use crypto assets only (hereafter, *Crypto only*). Among the crypto asset owners, the heterogeneity of *Both yes* and *Crypto only* groups is substantial in the case of credit cards. Those indicating *Both yes* for credit cards tend to have no financial education experiences at school, to have higher credit card literacy, and to have no financial trouble experiences, such as bank transfer fraud or multiple debts in comparison with those indicating *Crypto only*. The *Both yes* responders

for credit cards tend not to be myopic, to be less over-confident about their financial literacy, and to be less loss-averse in comparison with the *Crypto only* responders. These *Both yes* responders for credit cards are likely to have greater financial assets, to be 25–29 and 65–69 years of age, and to be female in comparison with the *Crypto only*. In the case of electronic money, the *Both yes* responders are not biased to younger generations and they tend to have higher educational attainments in comparison with *Crypto only*. However, the heterogeneity of *Both yes* and *Crypto only* responders is limited for debit cards and mobile payments via smartphones. In the case of debit cards, the *Both yes* responders tend to be less subject to herding in comparison with *Crypto only*. In the case of mobile payments via smartphones, *Both yes* responders tend to be less subject to herding, show more self-control, and greater loss aversion in comparison with *Crypto only*.

Before moving on to the details of our analysis, we summarize the related literature. Our paper closely relates to six studies that used microdata: two in the US (Schuh and Shy, 2016; Hundtofte et al., 2019); three in Canada (Henry et al., 2019a, 2019b, 2018); and one in Austria (Stix, 2018). In the results of the US studies, Schuh and Shy (2016) showed that a typical Bitcoin owner is more likely to be a younger, non-white male with a lower education level. Younger and lower-income consumers tend to make greater use of crypto assets. Consumers that use debit cards and prepaid cards relatively more often are less likely to use Bitcoin. Hundtofte et al. (2019) studied 1,146 people who were surveyed by the May 2018 Survey of Consumer Expectations. They showed that the actual and potential ownership of cryptocurrencies is concentrated in younger, wealthier demographics. Younger individuals are more likely, on average, to report greater knowledge of cryptocurrencies. Henry et al. (2019a) used Canadian surveys on crypto

assets to show that younger people and men are the ones most likely to own Bitcoin. In addition, higher education levels, higher income levels, and a lower level of financial literacy (as measured "Big 3" questions by Lusardi and Mithchell, 2014) are positively associated with Bitcoin ownership. The authors also used, as an indicator, the variable of Bitcoin knowledge scores. They found that those with positive scores show the highest levels of Bitcoin adoption. Henry et al. (2019b) found that the more educated Canadians are more likely to adopt contactless debit or credit card and mobile payment technologies, while the less educated Canadians are adopting Bitcoin. Higher income is an important predictor of contactless debit or credit card adoption, whereas this variable does not appear to be significant for Bitcoin. For online payment methods (debit and credit cards), regional and age predictors are similar to those for Bitcoin, whereas income and education factors show opposite effects. Through descriptive analysis, Stix (2018) showed that Austrian crypto asset owners are younger and more likely to be male. The probit regression for adoption showed that owners are more risk-tolerant, are more likely to be invested in other risky financial assets, and have higher levels of financial knowledge (measured by the quality of the newspapers they read), on average, than non-owners of crypto assets. However, to the best of our knowledge, no other study has used Japanese data to investigate the difference between owners and non-owners—as well as the heterogeneity among owners—in detail. Unlike these studies, the FLS 2019 does not distinguish between the awareness and adoption of crypto assets. Instead, it focuses on the use of crypto assets and on crypto asset owners' understanding of their nature. In addition, the FLS covers the use of other payment methods. We focus our study on usage and on comparison with other payment methods, similar to what is found in Schuh and Shy (2016) and Henry et al. (2019b). Another strength of the FLS 2019 is the data

gathered on financial literacy and behavioral economics, which can be compared with the analyses by Stix (2018) and Henry et al. (2019a).

In Japan, Kawamura et al. (2019) found that investors who have experience of investing in five speculative financial assets tended to be of the male gender and to have a higher level of financial literacy. They also tended to be young, less loss-averse, less risk-averse, and over-confident in their financial literacy. Unlike Kawamura et al. (2019), we focus on crypto asset owners in this study. Fujiki (2019) used data from 2007 to 2017 to study consumer choices on payment methods. Fujiki showed that both credit card users for day-to-day payments of over 10,000 yen and electronic money users for day-to-day payments of below 1,000 yen tend to have higher disposable incomes, greater financial assets, and better financial literacy, as measured by their understanding of the deposit insurance system. They also tend to be young, female, and not self-employed, as well as to have higher educational attainments and to live in large cities—in comparison with cash-only users (see details in Fujiki, 2019, Appendix Table 1). Nevertheless, Fujiki (2019) did not study the adoption of crypto assets, debit cards, and mobile payments via smartphones, due to a lack of data.

The rest of this paper is organized as follows. Sections 2 and 3 explain the data on crypto assets and choice of payment methods available in the FLS, respectively. Section 4 discusses the other variables obtained from the FLS, which are used as conditioning variables. Section 5 reports on the results of the regressions and Section 6 presents our conclusions.

2. Crypto asset data in the FLS

We begin by explaining the FLS data on the adoption, use, degree of understanding, and

profit from investing in crypto assets.

First, the FLS asks whether or not the respondents have adopted crypto assets during the past three years (for the details of this question, see the Appendix). Second, if the respondents have adopted crypto assets, then they are asked to choose their degree of understanding related to the crypto assets they have adopted. They select their answers from among the following choices: I understand the product details well enough to be able to explain them to other people (hereafter, "understand very well"); I understand the product details to a certain extent (hereafter, "understand to some extent"); I do not understand the product details so well (hereafter, "do not understand so well"); and I do not understand the product details (hereafter, "do not understand"). Finally, the FLS asks the adopters of crypto assets whether they have profit or loss, or whether they break even (including the cost of mining, purchase and sale, and capital gain or loss as of today) from their investment in crypto assets.

In Figure 1, the white bars show the percentage of each response given by all respondents (from 25,000 observations). The gray bars show the percentage of each response among those respondents who stated that they select financial products themselves when making investment decisions (among 15,517 observations). In these two samples, 92% and 90% of respondents have not adopted crypto assets, respectively. Because we are interested in the relationship between the financial literacy and investment behavior of investors, the following analysis focuses on the subsample of those who stated that they select their financial products. Figure 1 shows that, in the subsample, 13,895 (90%) respondents had not adopted crypto assets. The remaining 1,622 (10%) respondents had adopted crypto assets during the last three years.

In the US, from 2014–2015, crypto asset owners constituted 1% of the

population (Schuh and Shy, 2016). More recently, 5% of US respondents were found to currently own or to have previously owned cryptocurrency (Hundtofte et al., 2019). In Canada, it was also 5% (Henry et al., 2019a), while in Austria it was 1.5% (Stix, 2018). Japan's crypto asset ownership rate of about 10%, according to the FLS, seems high in comparison to the rates presented in these foreign studies. However, two other Japanese data sources indicate that the country's crypto asset ownership may be comparable with what is reported in these foreign studies.

First, an annual internet survey by Nikkei Research, called Japan's Personal Assets Database "RADAR" (hereafter, RADAR), which includes information on the adoption of crypto assets. Two editions of RADAR were useful for our purposes because one was conducted before and one after the FLS 2019. RADAR 2018, which was conducted between June 13, 2018 and June 18, 2018, found that 155 of those surveyed (or 5.1% of 3,065 observations) said that they had adopted crypto assets. RADAR 2019 was conducted between June 26, 2019 and July 1, 2019. Of those surveyed, 179 (5.8% of 3,112 overall observations) said that they had adopted crypto assets (including those who had adopted crypto assets in the past but were not in the possession of them at the time of the survey). RADAR surveys people aged 20–74 but includes only those living in the Tokyo metropolitan area and its four surrounding prefectures: Ibaraki, Saitama, Chiba, and Kanagawa. If we focus on the subsample of the FLS 2019 that lives in the Tokyo metropolitan area and its four surrounding prefectures, as RADAR 2018 and 2019 do, then the FLS 2019 would contain only 660 crypto asset owners (8.4% of 7,817 observations).

Second, an internet survey on crypto assets—conducted by My Voice in March 2018—showed that about 80% of the respondents in Japan were aware of crypto assets

and 2.2 % were crypto asset owners. Another 0.6% had held crypto assets in the year 2017 but not in the year 2018.[1] We do not know which of the data sets most closely represent the percentage of Japanese citizens who own crypto assets; nevertheless, we continue our examination of the FLS data.

Figure 1 further shows that—among the 1,622 crypto asset owners surveyed—1.3% of respondents (or 13% of crypto asset owners) do not understand crypto assets. Another 2.7% (26%) do not understand crypto assets so well, while 4.6% (44%) of respondents understand crypto assets to some extent; and 1.8% (or 17% of crypto asset owners) understand crypto assets very well. About 40% of owners, then, have purchased crypto assets without having a solid understanding of them . The results reported in Figure 1 urge us to examine which demographic characteristics correlate with such a risky investment decision—for example, lack of financial literacy, herding, age, gender, or educational attainment.

Figure 2 shows the number of crypto asset owners, according to profitability of investment and understanding of crypto assets. We find that owners who responded that they understand very well or to some extent tend to earn profits. Meanwhile, the respondents who stated that they do not understand or do not understand so well tend to experience losses.

Note that the FLS 2019 does not ask what motivated the respondents' use of crypto assets when it asks about the profitability of investment and understanding of crypto assets. Thus, one might well wonder whether investment was the respondents' only reason for holding crypto assets. On this point, the 2018 edition of RADAR asked some

[1] See details on the My Voice website: https://myel.myvoice.jp/products/detail.php?product_id=23605. The survey included 10,857 individuals.

of the respondents to provide their reasons for using crypto assets. The replies of the 72 respondents who had adopted crypto assets and wanted to use them indicated that: 60% aimed to make a speculative investment, 38% wished to study crypto assets and blockchain technology, 31% wanted to buy goods and services on the internet, 24% aimed to make international remittances, and 19% wished to buy goods and services in physical stores. Judging from the results of the 2018 edition of RADAR, the FLS 2019's focus on investment motivation does not seem to be problematic.

Note also that the FLS questions on the profitability of investment from crypto assets and about the understanding of crypto assets are both self-reporting—therefore, the responses could be biased. We also do not know to what extent the crypto asset transactions made by the respondents might have been related to illegal or shadow economy activities, and we do not know which currency exchanges were used by the respondents.

3. Payment method data in the FLS

Here, we explore the FLS data on payment methods, through Question 45: "How often do you use the following payment methods: credit cards, debit cards, electronic money, mobile payments via smartphones, cash? Choose only one answer from the following options: Almost every day; About once a week; About once a month; Scarcely or never; Do not adopt it." In this question, mobile payments via smartphones can be prepaid or post-paid, QR-code based, or in the form of mobile wallets for credit cards, debit cards, or electronic money. Cash includes checks. Here, we focus on the use of credit cards, electronic money, debit cards, and mobile payments via smartphones. We consider the respondents who chose the answers "Almost every day," "About once a week," and

"About once a month" to be the users of each payment method.

Question 45 aims to examine the effects of a policy made by the Ministry of Economy, Trade and Industry of Japan (METI), which has the aim to subsidize cashless payments in some registered retail shops by June 30, 2020—following the increase in the consumption tax rate on October 1, 2019. The plan is to increase the cashless payment rate from 20% to 40% by 2025. The METI subsidized both users and registered shops that accepted cashless payments—including those carried out by credit cards, electronic money, debit cards, and mobile payments via smartphones during these six months. Users of cashless payments received a discount of 2% or 5% on purchases made at registered retail shops. The registered retail shops received a 75% subsidy for the costs of introducing new registers and terminals that accepted cashless payments. These registered retail shops also enjoyed the upper limit of the merchant fee of 3.25% (with a 1.08% subsidy). As summarized in Fujiki (2019), Japanese people use credit cards for higher-value day-to-day transactions. They use electronic money (via contactless prepaid cards, which became available in Japan after 2001) for lower-value day-to-day transactions at convenience stores, train and subway stations, and supermarkets. The use of debit cards (including both cash withdrawal cards, accepted only within Japan, and internationally branded debit cards) was not as popular in Japan as electronic money, until recently. Major banks started issuing branded debit cards in 2013 and the volume of transactions made the use of branded debit cards increase substantially (Bank of Japan, 2019). Mobile payments via smartphones are brand new to Japan. It was only around the end of 2018 that many Japanese people became aware of the existence of these services. This was because many new payment companies—held by nonbanks, such as cell-phone carriers, internet providers, and a social networking service company—offered discounts for their

payment services using QR-code, anticipating METI's policy. Hence, some FLS 2019 (conducted in March 2019) respondents may have known about these new services before they responded to the survey.

Figure 3 shows the choices made between four noncash payment methods, according to ownership of crypto assets. For each payment method, we classify the respondents into four groups: those who use neither noncash payment methods nor crypto assets (hereafter, *Both no*, black bar); those who use crypto assets only (hereafter, *Crypto only,* gray bar); those who use a payment method but do not have crypto assets (hereafter, *CEDS only,* light gray bar [*CEDS* stands for credit cards, electronic money, debit cards, or mobile payments via smartphones, depending on the payment methods to be compared]); and those who use both (hereafter, *Both yes,* white bar). Figure 3 shows that credit cards and electronic money are very often used and that the majority of Japanese people do not use debit cards or mobile payments via smartphones (hereafter, *Smartphone*). Based on the data in Figure 3 that is conditional on crypto asset ownership, 84% use credit cards, 70% use electronic money, 24% use debit cards, and 40% use mobile payments via smartphones. Conditional on the crypto asset non-ownership data, 81% use credit cards, 62% use electronic money, 7% use debit cards, and 17% use mobile payments via smartphones. Consequently, the ownership of crypto assets is associated with greater use of noncash payment methods, especially debit cards and mobile payments via smartphones. Finally, conditional on the use of noncash payment methods, the ratio of crypto asset owners among the users of credit cards, electronic money, debit cards, and mobile payments via smartphones are 11%, 28%, 12%, and 22%, respectively. Schuh and Shy (2016) showed that consumers who use debit cards and prepaid cards relatively more often are less likely to use Bitcoin. Our data shows that consumers who

use credit cards and debit cards are less likely to use crypto assets.

Figure 4 shows the partial relationship between age and the use of noncash payment methods as well as crypto assets. It shows that younger age is one of the key demographic characteristics of crypto asset ownership. Note the relationship between age and credit cards (shown by the thin solid line). The ratio of credit card users, among those below age 25, is lower than that of electronic money users. Meanwhile, the ratio of credit card users remains at around 80% for the other age groups. These results are consistent with the results of the annual survey conducted by the Japan Credit Bureau (one of the oldest credit card issuers in Japan), which shows that—although 84% of survey respondents have credit cards—65% of males below age 30 and 78% of females below age 30 have credit cards.[2] One reason for the low rates of credit card adoption among respondents below the age of 30, may be the high percentage of students in this age group. If we exclude students, indicated by the thick solid line, the ratio of credit card users below age 25 exceeds that of electronic money. Nevertheless, the ratio remains below 70%. The ratio of electronic money users is high among those aged 50–59. The rates of crypto asset users, debit card users, and users of mobile payments via smartphones all fall with age.

4. Demographic variables in the FLS

We use various demographic variables in the remaining analysis, following Sekita et al. (2018) and Kadoya and Kahn (2020) who used the same questions available in the FLS 2016 data. These include questions related to understanding of crypto assets, financial

[2] The survey is available at: https://www.global.jcb/ja/press/news_file/file/report2018.pdf (accessed February 22, 2020).

literacy, variables related to behavioral economics (hereafter, "financial behavior"), sources of information on finance, and experience of investing in three types of risky assets—together with standard demographic variables, such as pretax income, total household financial asset holdings, age, gender, employment status, and educational attainment—which we explain below. The details of the construction of these variables are reported in the Appendix.

First, we construct an indicator variable named *Crypto understand*. It takes a value of 4 for households choosing "understand very well;" a value of 3 for households choosing "understand to some extent;" a value of 2 for households choosing "do not understand so well;" and a value of 1 for households choosing "do not understand."

Second, we follow Sekita et al. (2018) in using a proxy for objective financial literacy. *Objective financial literacy* is defined as the number of correct answers to 10 questions. These include the "Big 3" questions on compound interest, inflation, and stock risk that are used to measure personal financial literacy (see Lusardi and Mitchell, 2014), along with seven questions on the trade-offs between the risk and return of financial assets, life insurance, mortgages, interest rates, and bond prices. We follow Kadoya and Khan (2020) in using the frequency of obtaining information on financial and economic conditions from mass media (*News*) and the experience of financial troubles, such as bank transfer fraud or multiple debts (*Fraud1*). We add to Sekita et al. (2018) and Kadoya and Kahn (2020) using dummy variables of financial education experiences at school (*Fin. education school*) or in the household (*Fin. education home*), debt holdings (*Debt*), and knowledge about credit cards (*Credit card literacy*).

Third, we follow Sekita et al. (2018) and use six variables that capture financial behavior from the perspective of behavioral economics (see Beshears et al., 2018, for

literature on behavioral household finance). *Myopia* captures the present-biased preferences in which one places extra value on more immediate awards. *Herding* is a proxy variable that shows whether a person prefers to follow others in making financial decisions. *Self-control* is a proxy of the degree to which a person makes deliberate and well-thought-out decisions. *Over-confidence* captures one's over-confidence regarding financial literacy through the difference between one's subjective financial literacy (self-evaluation of one's level of financial literacy in comparison to other people) and *Objective financial literacy*.[3] *Loss aversion* is a dummy variable that takes a value of 1 for a person who says "no" to the question "If you invested 100,000 yen, you would either get a capital gain of 20,000 yen or a capital loss of 10,000 yen at 50% probability." Finally, *Risk aversion* is a proxy value for the extent to which a person is reluctant to take a risk on an investment. A higher value of *Risk aversion* is associated with a higher degree of risk aversion.

Fourth, we use dummy variables to indicate respondents' sources for obtaining information on financial and economic conditions. These include those who obtain information from financial institutions only (*S_fin*); those who obtain it from websites only (*S_net*); those who obtain it from financial experts, financial institutions, and other sources (*S_fin_exp*); those who obtain it from financial institutions and websites but excluding financial experts (*S_fin_net*); and the rest of the respondents (*S_other*). The base case for these dummy variables comprises respondents who stated that they do not know what their sources are (*S_do_not_know*), which is not reported in Table 1.

Fifth, we use dummy variables to indicate the experience of investing in three

[3] Note that *Over-confidence* is not measured using the gap between the self-perceptions of the score of *Objective financial literacy* and the actual score of *Objective financial literacy* done by Anderson et al. (2017).

types of risky assets: stocks (*s*), investment trusts (*i*), and foreign currency denominated deposits and MMFs (*f*). We construct the *sif* variable for those who have experience investing in all three of these asset types; the *s_i, s_f,* or *i_f* variables for those who have invested in two out of the three asset types; and *s_only, i_only,* and *f_only* variables for those who have invested in only one of these risky asset types.

In addition, we use dummy variables to indicate: the annual pretax household income (*Income*) by ranges (in units of 10,000 yen); the total household financial asset holdings (*Assets*) by ranges (in units of 10,000 yen); the gender of respondents (*Male* = 1 for men); the ages of respondents by ranges (*Age*: below 25, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74, 74–79); the employment status of respondents (*Private* company, *Public* company, *Teacher*, *Self-employed*, *Part-time*, *House* [meaning no jobs or no schooling], and *Student*); the educational attainment of respondents (*Senior high*, *Vocational college*, *Junior college*, *University*, and *Graduate,* where the base case is below *Senior high*); and the nine areas of residence (the base case is the *Kanto* region).

Table 1 reports the averages and standard deviations (hereafter as S.D.) of these variables—by ownership of crypto assets—in addition to *Crypto understanding*, which is available only for owners of crypto assets. We note some differences between the averages of these two groups. Surprisingly, crypto asset owners have lower objective financial literacy and credit card literacy than non-owners, on average. However, these results are consistent with the findings of Henry et al. (2019a, Table 4).[4] Crypto asset

[4] Crypto assets owners have lower objective financial literacy than non-owners even if we use the financial literacy index based on the standard "Big 3" questions by Lusardi and Mitchell (2014), which takes values of 1.692 for owners and 1.743 for non-owners. The correlation coefficients between *Objective financial literacy* and the financial literacy index based on the "Big 3" questions are 0.803 and 0.835 for owners and non-owners, respectively.

owners obtain information on economy and finance from mass media more frequently, as seen in the higher average value of *News*.

Regarding the variables related to financial behavior, crypto asset owners are also more likely to be myopic, subject to herding, and over-confident about their financial literacy. They are less likely to show self-control and are less risk-averse and loss-averse than non-owners, on average. They are also more likely to obtain information from financial experts, as seen in the higher average value of *S_fin_exp*. They are more likely to have experience investing in all three types of risky assets (*s*, *i,* and *f*) than non-owners are, on average, as seen in the higher average value of *sif*.

Regarding the other demographic variables, crypto asset owners are biased toward younger generations—those aged below 40. They are also more likely to be male, to work in private companies, and to have graduated from university. Next, we examine whether these differences in unconditional averages between owners and non-owners show up even after we control for the remaining demographic variables using probit regressions and multinomial logit regressions.

5. Regression analysis

5.1. Comparison between owners and non-owners

The second column of Table 2 reports the marginal effects, which are computed using the parameter estimates of a probit model of regressing a dummy variable, which takes a value of 1 for respondents adopting crypto assets and a value of zero otherwise, on the variables reported in Table 1. We use the probit Stata 16 command to estimate the parameters of the model, while we use the margin command to compute the marginal effects reported in Table 2. Although we do not report the standard errors of the marginal

effects, we do include superscripts *, **, and *** to denote the statistical significance at the 10%, 5%, and 1% levels, respectively.[5] Parameter estimates for areas of residence are not reported because they are not statistically significant. The second column of Table 2 shows the following tendencies of crypto asset owners in comparison to non-owners.

In terms of the variables related to financial literacy, owners are associated with obtaining information on economy and finance from mass media more frequently. They also tend to have more experience of financial troubles, such as bank transfer fraud or multiple debts, as well as lower credit card literacy in comparison to non-owners, which is consistent with the results in Table 1. However, unlike the results in Table 1, the relationship between crypto asset ownership and levels of objective financial literacy is not statistically significant.

With respect to financial behavior, average owners tend to be myopic, subject to herding, lacking in self-control, over-confident in their financial literacy, and less loss-averse than non-owners. This is consistent with the results in Table 1. The finding that owners are less loss-averse in comparison to non-owners is consistent with the results from Austria (Stix, 2018).

Concerning information sources, owners are more likely to have favorite information sources in relation to economy. When it comes to investment experience, owners are more likely to have experience investing in three types of risky assets, which is consistent with the results from Austria (Stix, 2018). Regarding the other demographic variables, owners are also more likely to be young and male. This is consistent with the

[5] Standard errors are adjusted to intragroup correlation within the clusters formed by gender, age group, and prefecture. This is because the FLS respondents are randomly chosen through cluster sampling—based on gender, 6 age groups, and 47 prefectures (2*6*47 = 564 clusters)—from among the people who registered with an internet survey company.

studies in the US (Schuh and Shy, 2016), Canada (Henry et al., 2019a), and Austria (Stix, 2018). Owners are more likely to work in private companies than in public companies. They are also more likely to be self-employed, to have no job, or to have no schooling. Furthermore, owners tend to have lower levels of educational attainment, which is consistent with the results of the studies in the US (Schuh and Shy, 2016) and Canada (Henry et al., 2019b).

5.2. Characteristics of owners, according to their understanding of crypto assets

Columns three through seven of Table 2 report the results of the marginal effects computed using the parameter estimates of a multinomial logit model regressing an indicator variable on the variables reported in Table 1. We use the following indicator variable; a value of 4 is applied for respondents who replied that they understand very well; a value of 3 for respondents who replied that they understand to some extent; a value of 2 for respondents who replied that they do not understand so well; a value of 1 for respondents who replied that they do not understand. A value of zero is applied for respondents who have not adopted crypto assets. We use the Stata 16 mlogit command to estimate the parameters of the model, while we use the margin command to compute the marginal effects reported in Table 2.

Note that the sum of the marginal effects reported in the second column and in the seventh column is very close to zero. This means that the marginal effects for the respondents who have not adopted crypto assets from the probit model and those from the multinomial logit model are very close. Therefore, we should focus on the results in columns three to six, which decompose the marginal effects for those respondents who have adopted crypto assets from the probit model reported in the second column,

according to the respondents' understanding of crypto assets. The parameter estimates for areas of residence are not reported because they are not statistically significant, except in two cases.

Many of the results of the average crypto asset owners, as reported in the second column, are consistent with owners who replied that they understand very well. However, the owners who replied that they understand very well are not related with obtaining information on economy and finance from mass media more frequently. They are also not associated with *Myopia*, *Self-control*, and *Loss aversion*. They are likely to have financial assets of between 2.5 million yen and 10 million yen and are not associated with jobs in private companies nor with self-employment and lower educational attainment. Instead, they are relatively wealthy, not loss-averse, and less likely to be related to the behavioral variables listed above—in comparison to non-owners. Notably, the owners who reply that they understand very well tend to be younger. This is consistent with the findings of Hundtofte et al. (2019): individuals belonging to younger age groups are more likely to report greater knowledge of cryptocurrencies.

Most of the results for average crypto asset owners are consistent with those of the owners who replied that they understand to some extent. However, those who replied that they understand to some extent are positively associated with objective financial literacy and are not associated with *Myopia, Herding*, *Self-control,* and having jobs in private companies. They have better objective financial literacy and are less likely to be related to the behavioral variables listed above in comparison to non-owners. The positive association with objective financial literacy is consistent with the findings by Stix (2018).

For crypto asset owners who replied that they do not understand so well, many variables are not consistent with the results of average crypto asset owners. They are not

correlated with obtaining information on economy and finance from mass media more frequently nor with receiving financial education at home or school, the experience of financial troubles (such as bank transfer fraud or multiple debts), *Credit card literacy*, *Myopia*, or *Over-confidence*. They are positively associated with *Risk aversion* and they are not associated with jobs in private companies, public companies, self-employment, and lower educational attainment.

For crypto asset owners who replied that they do not understand, many variables are inconsistent with the results of average crypto asset owners. They are negatively associated with *Objective financial literacy*, which is consistent with the results of Henry et al. (2019a, Table 6). They are not correlated with obtaining information on economy and finance from mass media more frequently nor with financial education at home, the experience of financial troubles (such as bank transfer fraud or multiple debts), *Credit card literacy*, *Myopia*, or *Self-control*. They are not associated with jobs in public companies, self-employment, or lower educational attainment.

In sum, many of the results of average crypto asset owners, as reported in the second column, are consistent with owners who replied that they understand very well and understand to some extent. Nevertheless, the owners' financial literacy and educational attainments vary, depending on their understanding of crypto assets, as follows. First, on average, the relationship between crypto asset ownership and level of objective financial literacy is not statistically significant. However, the owners who replied that they understand to some extent tend to have better objective financial literacy, while the owners who replied that they do not understand tend to have lower financial literacy. Second, owners are less likely to have experience in financial education at home, on average, in comparison with non-owners. However, the owners who replied that they

understand very well tend to have experience of financial education at home, while the owners who replied that they do not understand tend not to have experience of financial education at home. Third, owners are over-confident about their financial literacy, on average, in comparison with non-owners. The owners who replied that they understand very well or understand to some extent tend to be over-confident about their financial literacy. Meanwhile, the owners who replied that they do not understand tend not to be over-confident in their level of financial literacy. Finally, an average crypto asset owner tends to be negatively associated with a higher level of educational attainment—yet it is only the owners who replied that they understand to some extent who share the same results. Such results suggest that it is important to distinguish between objective financial literacy and specific knowledge about a particular financial product. Owners tend to have different levels of objective financial literacy, depending on their level of understanding of crypto assets.

5.3. Characteristics of owners, according to the profitability of their investment in crypto assets

In the previous section, we argue for the importance of distinguishing between objective financial literacy and specific knowledge about a particular financial product. To support our argument, we now examine the relationships among objective financial literacy, level of understanding of crypto assets, and profitability of investment in crypto assets. We limit our attention to a sample of 1,622 crypto asset owners and run the following multinomial logit regression. We regress the indicator variable of the profit from the crypto asset investment (*Profit*, *Break even*, and *Loss*) on the variable in order to show the level of understanding of crypto assets (*Crypto understand*) and the demographic

variables used in Table 2. The marginal effects, computed using the parameter estimates of the multinomial logit model, are reported in Table 3. The parameter estimates for the areas of residence are not reported because they are not statistically significant, except in one case.

Table 3 shows that a better understanding of crypto assets is positively associated with *Profit* and negatively associated with *Break even* and *Loss.* Objective financial literacy is not statistically significant for *Profit*, *Break even,* and *Loss*. Meanwhile, credit card literacy is negatively correlated with *Break even* and positively correlated with *Loss*. These results suggest that specific knowledge about crypto assets among owners is a more important factor—related to the profitability of crypto asset investment—than general financial literacy or literacy on other payment methods, such as credit cards, in predicting the performance of an investment in crypto assets. Note that we do not make any causal inferences and we advise being careful about making policy recommendations that take these results literally. For example, those crypto asset owners who made a profit by chance might think that they made a profit—not because of good luck but because they understood the crypto asset very well.

Along with the variables related to financial literacy, Table 3 also shows that *Profit* is positively associated with frequently obtaining information on economy and finance from mass media; with financial education at home; with experience of financial troubles (such as bank transfer fraud or multiple debts); with experience of investing in investment trusts, and foreign currency denominated deposits and MMFs; with pretax income higher than 15 million yen; and with being 30–34 years of age. It is negatively associated with experience of investing in investment trusts, and foreign currency denominated deposits and MMFs; and with holding jobs in private companies. On the

other hand, *Loss* is positively associated with *Credit card literacy* and with being 60–64 years of age. It is negatively associated with financial education at school and home, self-control, risk aversion, obtaining information from financial institutions and the Internet, experience of investing in stocks, investment trusts, and foreign currency denominated deposits and MMFs (*sif*), pretax income higher than 15 million yen, and financial asset holdings of over 10 million yen. The results show a striking difference in variables related to the financial literacy of crypto asset owners—when classified by the profit earned from their investment in crypto assets and conditional on their level of understanding of crypto assets.

5.4. Characteristics of owners, according to other risky asset holdings

Do owners of other risky assets share similar demographic characteristics with crypto asset owners? This is an interesting question. Stix (2018) showed that Austrian crypto asset owners are more likely to be invested in other risky financial assets. Since the FLS includes questions about respondent experiences of owning stocks, investment trusts, and foreign currency denominated deposits and MMFs, we run probit regressions using the dummy variables for respondents who have experience of holding stocks (*s*), investment trusts (*i*), and foreign currency denominated deposits and MMFs (*f*), in addition to crypto asset ownership, as dependent variables. Specifically, we run probit regressions on the set of demographic variables reported in Table 1 using the *sif* variable for those who have experience investing in all three assets; the *s_i, s_f,* and *i_f* variables for those who have experience with two out of the three assets; and the *s_only, i_only,* and *f_only* variables for those who have experience with one of these risky asset types—and excluding the variables related to *s, i,* and *f*. Marginal effects, computed using the parameter estimates

of these probit regressions, are summarized in Table 4. The parameter estimates for areas of residence are not reported, because they did not yield interesting results.

The fourth and fifth columns in Table 4 show that the marginal effects of the variables related to financial literacy and financial behavior on *sif* and *s_i* are similar to the results of average crypto asset owners shown in the second column of Table 4, as reported in the second column of Table 2. *Objective financial literacy* is positive and significant in the second column of Table 4 because we do not control the experience of investment in other assets—unlike the results in the second column of Table 2. However, the marginal effects of financial asset holdings and age on *sif* and *s_i* are opposite to the results for the adoption of crypto assets. Respondents holding more than 50 million yen in financial assets are positively associated with investments in *sif* and *s_i*, and higher ages are positively associated with investments in *s_i*. Higher educational attainment—*Junior college* and *Graduate*—are also positively associated with *sif*, while these variables are not statistically significant for crypto assets.

Apart from asset holdings and age, most results for *sif* are similar to those for average crypto asset owners. Because we found heterogeneity within crypto asset owners in the previous subsection, according to their levels of understanding around crypto assets, we now focus on the 1,622 observations of those who adopt crypto assets. We also investigate who would be likely to choose *sif* (who owns stocks, investment trusts, and foreign currency denominated deposits and MMFs). Table 5 reports the marginal effects obtained from the parameter estimates of the probit regression using these subsamples, making the crypto asset owners whose *sif* takes a value of zero as the base case. Within the subsample of crypto asset owners, the following results are consistent with the results of average crypto asset owners reported in Table 4. First, *sif* owners tend to, on average,

have higher *Objective financial literacy*. Second, they also tend to obtain information on economy and finance from mass media more frequently, to have experience of financial education at school, and to have lower credit card literacy. Third, they tend to be subject to herding, to have less self-control, to be over-confident about their financial literacy, to be less loss-averse than non-owners, and to use various information sources for economy. Last, they are more likely to be male. Unlike the results of average crypto asset owners, as seen in Table 4, both crypto asset and *sif* owners tend to have no experience of financial troubles like bank transfer fraud or multiple debts. They tend not to be myopic, are likely to have greater financial assets, and are unlikely to be younger. The results suggest that, among crypto asset owners, those investors who are well-diversified—in the sense that they also own all three types of risky assets—tend to be wealthy and experienced investors with no experience of financial troubles, such as bank transfer fraud or multiple debts, and with low levels of financial myopia. The results again show a striking difference in the demographic background of crypto asset owners—when classified according to their holdings of the other three kinds of risky assets.

5.5. Characteristics of owners, according to their use of payment methods

Does the use of crypto assets relate to the use of other payment methods? This, too, is an interesting question, similar to the ones posed by Schuh and Shy (2016) and Henry et al. (2019b).

Here, we examine the choices of four groups: those who neither use noncash payment methods nor crypto assets (*Both no*); those who use crypto assets only (*Crypto only*); those who use a payment method but do not have crypto assets (*CEDS only* [*CEDS* would be replaced by credit cards, electronic money, debit cards, or mobile payments via

smartphones, depending on the payment methods to be compared]); and those who use both (*Both yes*). We do so by applying a multinomial logit model, which uses the same explanatory variables that are reported in Table 1. We would like to uncover the differences between the owners with and without other payment instruments: *Crypto only* and *Both yes.* Because the use of credit cards is very popular in Japan, we are also interested in the differences between the users of credit cards without crypto assets and the users of credit cards with crypto assets: *CEDS only* and *Both yes*.

In columns three to six, Table 6 reports the marginal effects computed from the parameter estimates of the multinomial logit model for the use of crypto assets and credit cards. It shows that the statistically significant marginal effects for *Crypto only* and *Both yes* are consistent with the findings on average owners in the second column of Table 2. Crypto asset owners tend to have experienced financial troubles, such as bank transfer fraud or multiple debts, and to be less loss-averse. These owners tend to have their favorite information sources for economy and finance, to have experience of investing in the three types of risky assets, to be young and male, and to have lower educational attainment.

The choice of *Both yes* is also associated with obtaining information on economy and finance from mass media more frequently, having lower levels of credit card literacy, and having a tendency to work in private companies. It is likewise associated with being myopic and subject to herding, lacking self-control, and being over-confident about one's financial literacy, on average, in comparison to non-owners. This is shown in the second column of Table 2. In contrast, higher objective financial literacy is positively associated with the choice of *Both yes*. This is consistent with the results obtained for owners who replied that they understand to some extent, as reported in the fourth column of Table 2.

The choice of *Crypto only* is negatively associated with obtaining information

on economy and finance more frequently. The results for average owners, as reported in the second column of Table 2, seem to reflect the effects of choosing *Both yes* rather than *Crypto* only, except for the results on *Objective financial literacy*.

The results reported in the *Credit card only* columns show this choice to be associated with higher objective financial literacy. It is also associated with higher financial asset holdings, with being female, and with higher educational levels. These findings are consistent with Fujiki (2019). A unique finding of the present study is that *Credit card only* is also positively associated with *Credit card literacy*—but negatively associated with the experience of financial troubles, such as bank transfer fraud or multiple debts, *Myopia, Herding*, *S_fin*, and *S_fin_exp*, and with the experience of investing in the three other kinds of risky assets. This suggests that the choice of *Credit card only* is related to a financially literate person who does not seek out information from financial institutions or financial experts.

Another unique finding of the present study is that the choice of *Credit card only* is positively associated with age for all age groups, including people over 55 years of age. This is contrary to Fujiki (2019), who notably used different data around the choice of frequently used payment methods for day-to-day transactions, focusing on the spending amount obtained from the Survey of Household Finance (SHF) from 2007 to 2017.[6] The SHF data shows that the ratio of households that choose to pay by credit card exclusively, by cash and credit card, or by credit card and other payment methods falls after the age of 55. If an older person who chose *Credit card only* makes fewer high-value transactions in comparison with a young person and a middle-aged person, then it is natural that they

[6] Apart from the difference in the definition of the use of payment methods between the SHF and the FLS, the SHF is based on a stratified random sampling while the FLS is based on a web survey.

may not use their credit card as frequently and, thus, that they might not be counted as a frequent credit card user by the SHF, although they might be counted as a *Credit card only* user by the FLS.[7]

Finally, we examine the subsample of 1,622 Japanese people surveyed who have adopted crypto assets and investigate who would be likely to adopt credit cards as well. The seventh column of Table 6 reports the marginal effects obtained from the parameter estimates of the probit regression using these subsamples and applying crypto asset owners who have not adopted credit cards as the base case. Within the subsample of 1,622 crypto asset owners, those who also adopt credit cards (1,367 observations) tend to have higher *Objective financial literacy*, to obtain information on economy and finance from mass media more frequently, and to invest in three kinds of risky assets. This makes them similar to the average crypto asset owner. Unlike the results for the average crypto asset owners in the second column of Table 2, these owners tend to have no experience of financial education at school, to have higher credit card literacy, and to have no experience of financial troubles, such as bank transfer fraud or multiple debts. They are not myopic, tend to be less over-confident about their financial literacy, and less loss-averse. They are likely to have higher amounts of financial assets, to be 25–29 and 65–69 years of age, and to be female. The results again show differences in the demographic background of crypto asset owners—when classified by the adoption of credit cards.

In columns three to six, Table 7 reports the marginal effects computed from the parameter estimates of the multinomial logit model for the use of crypto assets and electronic money. The statistically significant marginal effects for *Crypto only* and *Both*

[7] Note that the positive association with age does not vary. This is true even if we use the alternative definition of credit card users, proposed in Figure 4, which excludes students or assumes credit card users to be those respondents who chose “Almost every day” and “About once a week.”

yes are consistent with the findings on average crypto asset owners presented in the second column of Table 2. These crypto asset owners tend to be more experienced with financial troubles (such as bank transfer fraud or multiple debts), less credit card literate, more subject to herding, less loss-averse, and associated with over-confidence in their own financial literacy. They are more likely to have favorite information sources and to have experience investing in the three types of risky assets. They are also more likely to be young and male. The choice of *Both yes* is also associated with obtaining information on economy and finance from mass media more frequently, lacking self-control, and working in private companies, as shown in the second column of Table 2. Unlike the second column of Table 2, *Objective financial literacy* is positively associated with the choice of *Both yes*. The choice of *Crypto only* is negatively associated with obtaining information on economy and finance from mass media more frequently and with higher level of educational attainment. The results for average owners, reported in the second column of Table 2, again seem to reflect the effects of choosing *Both yes* rather than *Crypto only*—except for the results of *Objective financial literacy* and educational attainment. The results reported in the columns labeled *Emoney only* (abbreviation of *Electronic money only*) show this choice to be associated with higher objective financial literacy, higher income, female gender, higher educational attainment, and urban areas. (Note that the base case for the region effects is Kanto, where most train commuters have electronic money issued by train companies). This is consistent with Fujiki (2019). However, the use of *Electronic money only* is associated with higher age, between 50 and 64, which is contrary to Fujiki's findings (2019). *Credit card literacy* is positively associated with the choice of *Electronic money only*. Finally, we examined the subsample of 1,622 observations of those who adopt crypto assets and investigate who would be

likely to adopt electronic money as well. The seventh column of Table 7 reports the marginal effects obtained from the parameter estimates of a probit regression using these subsamples, applying those crypto asset owners who have not adopted electronic money as the base case. Within the subsample of 1,622 crypto asset owners, those who also adopt electronic money (1,142 observations) tend to, on average, obtain information on economy and finance from mass media more frequently. This is similar to the average crypto asset owner. However, unlike the average crypto asset owner, both crypto asset and electronic money owners are unbiased toward younger generations and tend to have higher educational attainment.

Tables 8 and 9 report the marginal effects computed from the parameter estimates of the multinomial logit model for the use of crypto assets and debit cards and those computed from the parameter estimates of the multinomial logit model for the use of crypto assets and mobile payments via smartphones, respectively. The results for crypto asset owners (*Crypto only* and *Both yes*) are generally consistent with the results given in the second column of Table 2, except for the results for objective financial literacy (*Both yes* for mobile payments, in Table 9),[8] *Myopia* (*Both yes* for mobile payments, in Table 9), *Self-control* (*Both yes* for debit cards, in Table 8, and *Both yes* for mobile payments in Table 9); financial assets of more than 20 million yen (*Both yes* for debit cards, in Table 8); and educational attainment (*Crypto only* for mobile payments, in Table 9).

We examine the subsample of 1,622 respondents who have adopted crypto assets and investigate who would also be likely to adopt debit cards and mobile payments via smartphones. The seventh column in Table 8 shows that—within the subsample of 1,622

[8] Consistent with this result, Scheresberg et al. (2020) found that US mobile payment users aged 18–34 tend to have lower levels of financial literacy than non-users aged 18–34.

crypto asset owners—those who also adopt debit cards (393 respondents) tend to display similar demographic characteristics as the average crypto asset owner. They obtain information on economy and finance from mass media more frequently and are myopic and over-confident about their financial literacy. Yet they differ from the average crypto asset owner in being less subject to herding. The seventh column in Table 9 shows that, within the subsample of 1,622 crypto asset owners, those who also adopt mobile payments via smartphones (651 respondents) tend to obtain information on economy and finance from mass media more frequently. This group is also biased toward younger generations, similar to the average crypto asset owner. However, unlike the average crypto asset owner, the adopters of both crypto asset and mobile payments via smartphones are less subject to herding and they also show more self-control and loss aversion.

Note that the heterogeneity of crypto asset owners, regarding the adoption of debit cards and mobile payments via smartphones, seems to be relatively small in comparison to that the adopters of credit cards. This reflects the fact that the number of households choosing *Crypto only* is 3.1 and 1.5 times higher than the number of households choosing *Both yes*—in the case of debit cards and mobile payments via smartphones, respectively. Meanwhile, the number of households choosing *Crypto only* is 19% of those choosing *Both yes* in the case of credit cards (see Figure 3).

In sum, the results for the average crypto asset owner—as reported in the second column of Table 2—reflect the effects of choosing *Both yes* rather than *Crypto only* for the use of the four noncash payment methods. The important exception lies in the positive relationship between *Both yes* and *Objective financial literacy*. The results again show differences in the demographic backgrounds of crypto asset owners, especially when classified by their credit card adoption.

6. Conclusion

In this study, we investigated the key characteristics of Japanese crypto asset owners in detail. On average, crypto asset owners are found to be more likely to be young and male and to have lower educational levels than non-owners. This is consistent with the findings obtained from data in the US (Schuh and Shy, 2016), Canada (Henry et al., 2019a), and Austria (Stix, 2018).

Thanks to a rich data set—which included variables related to financial literacy, financial behavior, investment portfolio, and choice of payment method—we obtained the following novel findings on the demographic characteristics of average crypto asset owners. With respect to financial literacy, the average relationship between crypto asset ownership and objective financial literacy is not statistically significant; however, crypto asset owners obtain information on economy and finance from mass media more frequently. In addition, they are more experienced in terms of financial troubles, such as bank transfer fraud or multiple debts, and are less credit card literate than non-owners. In terms of their financial behavior, they tend to be myopic, subject to herding, lacking in self-control, over-confident in their financial literacy, and less loss-averse than non-owners, on average. The owners are more likely to have their favorite information sources on economy and finance and to have experience investing in the other three types of risky assets. They are also more likely to work in private companies than non-owners.

After establishing the demographic characteristics of average crypto asset owners, we examined the heterogeneity of crypto asset owners in four ways: through their levels of understanding of crypto assets, profitability of their investment in crypto assets, their holdings of other risky assets, and their adoption of other noncash payment methods.

These explorations were possible due to the relatively large number of crypto asset owners in our data set in comparison with previous studies. The main results, presented below, show a striking heterogeneity among crypto asset owners. This broadens the results beyond comparisons between crypto asset owners and non-owners that were obtained in previous studies.

First—with respect to the owners' varying degrees of understanding about crypto assets—many results obtained for average crypto asset owners are consistent with owners who understand such assets very well or understand them to some extent. Some exceptions are noted below. The owners who stated that they understand crypto assets very well are relatively wealthy, not loss-averse, not likely to be myopic, and not lacking in self-control in comparison to non-owners. The owners who stated that they understand these assets to some extent have better objective financial literacy and are not myopic, not subject to herding, and not lacking in self-control. However, the results of the average crypto asset owner are not consistent with those of owners who stated that they do not understand these assets so well or that they do not understand them at all. The objective financial literacy of owners, especially, can be seen to vary depending on their understanding of crypto assets. The owners who stated that they understand crypto assets to some extent tend to have better objective financial literacy and to be over-confident about their financial literacy. Meanwhile, the owners who stated that they do not understand crypto assets tend to have lower objective financial literacy and tend not to be over-confident about their financial literacy. This study's consideration of the owners' levels of understanding of crypto assets may explain why Stix (2018) and Henry et al. (2019a) obtained the opposite results regarding the relationship between the level of financial literacy or financial knowledge and crypto asset ownership.

Second—with respect to the heterogeneity of crypto asset owners in terms of the profitability of their investment in crypto assets—a better understanding of crypto assets is positively associated with earning profits from investing in them. Nevertheless, objective financial literacy is not related to profiting from investment in crypto assets. While these results do not indicate a causal relationship, they suggest that specific knowledge of crypto assets is more important than general knowledge about finance in predicting the performance of an investment in crypto assets.

Third—with respect to the heterogeneity of crypto asset owners' holdings of other risky assets—most of the characteristics of the owners of stocks, investment trusts, and foreign currency denominated deposits and MMFs are similar to those of the average crypto asset owner, apart from the amount of asset holdings and age. However, if we restrict our attention to crypto asset owners who also hold some stocks, investment trusts, and foreign currency denominated deposits and MMFs, these owners tend to be wealthy and experienced investors. This owner subgroup tends not to experience financial troubles, such as bank transfer fraud or multiple debts, and tends not to be myopic in comparison to those crypto asset owners who do not hold any of these three other types of risky assets.

Fourth—with respect to the characteristics of crypto asset owners in terms of the adoption of credit cards, electronic money, debit cards, and mobile payments via smartphones—most characteristics of the average crypto asset owner are more similar to those owners who chose *Both yes* (those who use both crypto assets and one of the four payment methods) rather than to those who chose *Crypto only* (those who use crypto assets only). This holds true, except for the positive relationship between *Both yes* and *Objective financial literacy*. Among the crypto asset owners, the heterogeneity of *Both yes* and *Crypto only* is substantial in the case of credit cards. Unlike the average crypto

asset owner, the owners who responded with *Both yes* for credit cards tend to have no experience of financial education at school, to have higher credit card literacy, and to have no experience of financial troubles, such as bank transfer fraud or multiple debts, in comparison with *Crypto only* owners. They tend not to be myopic but to be less over-confident about their financial literacy and less loss-averse in comparison with *Crypto only*. They are likely to have greater financial assets, their age ranges are from 25 to 29 and from 65 to 69, and they are more likely to be female in comparison with *Crypto only*. In the case of electronic money, the *Both yes* reply is not biased toward young generations and those who responded this way tend to have higher educational attainments in comparison with *Crypto only*. Yet the heterogeneity of *Both yes* and *Crypto only* is limited to the two points below. First, in the case of debit cards, those who stated *Both yes* tend to be less subjected to herding, in comparison to those who stated *Crypto only*. Second, in the case of mobile payments via smartphones, those who stated *Both yes* tend to be less subjected to herding, to have more self-control, and to show more loss aversion in comparison with *Crypto only*.

Several reservations must be noted regarding our results. First, we used data from an internet survey, which may not constitute a representative sample of all Japanese citizens. Second, our data does not report the value of crypto asset holdings. Hence, it was not possible to perform a quantitative evaluation of crypto asset investments, as other studies have done. Third, our results do not show a causal relationship—instead, they show a statistical association. Consequently, we should be careful about making policy recommendations. Our baseline results, if taken literally, might lead to the conclusion that improving objective financial literacy reduces investment in crypto assets. Our second result might suggest that improving objective financial literacy would lead to a better

understanding of crypto assets or that a better understanding of crypto assets would lead to profitable investment in crypto assets. However, if people want to invest in crypto assets and, thus, to study such assets more thoroughly and obtain a better understanding of them—as indicated in the results for those who understand them to some extent—then financial literacy would be positively associated with crypto asset ownership, while the causation would lead from ownership to financial literacy. If the crypto asset owners who made a profit by chance believed that they had made a profit because they understood crypto assets well, then the causation would not lead from understanding to profit.

References

Bank of Japan. "Payment and Settlement Statistics." March 2019.

Anderson, Anders, Forest Baker, and David T. Robinson. "Precautionary Savings, Retirement Planning and Misperceptions of Financial Literacy." Journal of Financial Economics 126 (2): 383–98, 2017.

Beshears, John, James J. Choi, David Laibson, and Brigitte C. Madrian. "Behavioral Household Finance," *Handbook of Behavioral Economics – Foundations and Applications 1* (Vol. 1, Ch. 3, pp. 177–274), Elsevier B.V., 2018. https://doi.org/10.1016/bs.hesbe.2018.07.004

Fujiki, Hiroshi. "How Do We Choose to Pay Using Evolving Retail Payment Technologies? Some Additional Results from Japan." September 22, 2019.

Gan, Kikyusyo, Kondo Takanori, Shirase Yoko, and Misumi Takashi. "Japanese Investors' Investment in Risky Assets. Does Financial Literacy or the Source of Financial Information Matter?" (In Japanese), Keiei Zaimu Kenkyu, 39 (1–2), Japan Finance Association, 2019.

Gomes, Francisco, Michael Haliassos, and Tarun Ramadorai. "Household Finance." Journal of Economic Literature, 2020 [Forthcoming].

Halaburda, Hanna and Haeringer, Guillaume and Gans, Joshua and Gandal, Neil, The Microeconomics of Cryptocurrencies. NYU Stern School of Business, 2020. Available at SSRN: https://ssrn.com/abstract=3274331.

Henry, Christopher, Kim Huynh, Gradon Nicholls, and Mitchell W. Nicholson. "2018 Bitcoin Omnibus Survey: Awareness and Usage." Staff Discussion Paper 2019-10, Bank of Canada, 2019a.

Henry, Christopher, Kim Huynh, and Gradon Nicholls. "Bitcoin Awareness and Usage in Canada: An Update." The Journal of Investing Cryptocurrency, Special Issue 2019, 28 (3): 21–31, 2019b.

Henry, Christopher, Kim Huynh, and Gradon Nicholls. "Bitcoin Awareness and Usage in Canada." Journal of Digital Banking 2 (4): 311–337, 2018.

Hundtofte, Sean, Michael Junho Lee, Antoine Martin, and Reed Orchinik. "Deciphering Americans' Views on Cryptocurrencies." Liberty Street Economics, March 25, 2019. https://libertystreeteconomics.newyorkfed.org/2019/03/deciphering-americans-views-on-cryptocurrencies.html

Huynh, Kim P., Jozsef Molnar, Oleksandr Shcherbakov, and Qinghui Yu. "Demand for Payment Services and Consumer Welfare: The Introduction of a Central Bank Digital Currency." Staff Working Paper 2020–7, Bank of Canada, 2020.

Kadoya, Yoshihiko and Mostafa Saidur Rahim Khan. "Financial Literacy in Japan: New Evidence Using Financial Knowledge, Behavior, and Attitude." Sustainability 12 (9): 3683, 2020.

Kawamura, Tetsuya, Tomoharu Mori, Taizo Motonishi, and Kazuhito Ogawa. "Is

Financial Literacy Dangerous? Financial Literacy, Behavioral Factors and Financial Choices of Households." RISS Discussion Paper Series No. 77, The Research Institute for Socio-Network Strategies, Kansai University, 2019.

Lammer, Dominique, Tobin Hanspal, and Andreas Hackethal. "Who Are the Bitcoin Investors? Evidence from Indirect Cryptocurrency Investments." SSRN Electronic Journal, 2019. https://doi.org/10.2139/ssrn.3501549

Lusardi, Annamaria and Olivia S. Mitchell. "The Economic Importance of Financial Literacy: Theory and Evidence." Journal of Economic Literature 52 (1): 5–44, 2014.

Mester, Loretta J. "Modernizing Our Payments System." Remarks at the Fourth Annual Financial Literacy Day: Understanding Global Markets and Finance, Global Interdependence Center, University of South Florida, Sarasota-Manatee, Sarasota, FL. February 14, 2020.

Scheresberg, Carlo de Bassa, Andrea Hasler, and Annamaria Lusardi. "Millennial Mobile Payment Users: A Look into Their Personal Finances and Financial Behavior." ADBI Working Paper Series No. 1074, Asian Development Bank Institute, 2020.

Schuh, Scott and Oz Shy. "U.S. Consumers' Adoption and Use of Bitcoin and other Virtual Currency." Mimeo, 2016.

Sekita, Shizuka, Vikas Kakkar, and Masao Ogaki. "Wealth, Financial Literacy and Behavioral Biases: Evidence from Japan." Keio-IES Discussion Paper Series DP2018-023, Institute for Economic Studies, Keio University, 2018.

Smith, Christie and Aaron Kumar. "Crypto-currencies—An Introduction to Not-So-Funny Moneys." Journal of Economic Surveys 32 (5): 1531–1559, 2018.

Stavins, Joanna. "How Do Consumers Make Their Payment Choices?" Research Data

Reports Paper, No. 17–1, Federal Reserve Bank of Boston, 2017.

Stix, Helmut. “Ownership and Purchase Intention of Crypto Assets—Survey Results.” Working Paper 226, Oesterreichische Nationalbank, 2019.

van Rooij, Maarten, Lusardi, Annamaria, and Alessie Rob. “Financial Literacy and Stock Market Participation.” Journal of Financial Economics 101 (2): 449–472, 2011.

Figure 1 Adoption and understanding of crypto assets

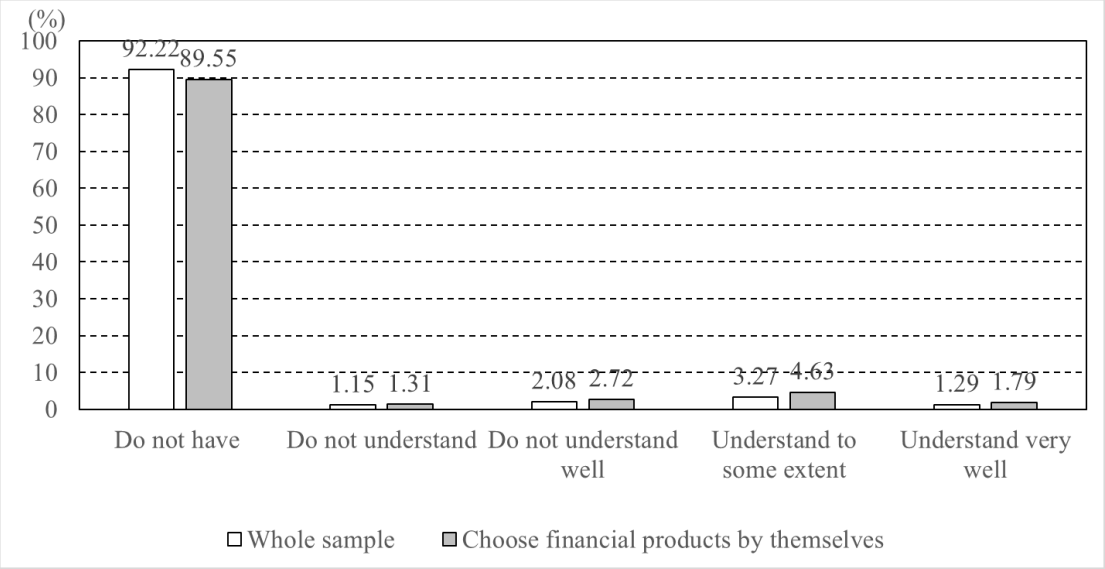

Figure 2 Profitability and understanding of crypto assets

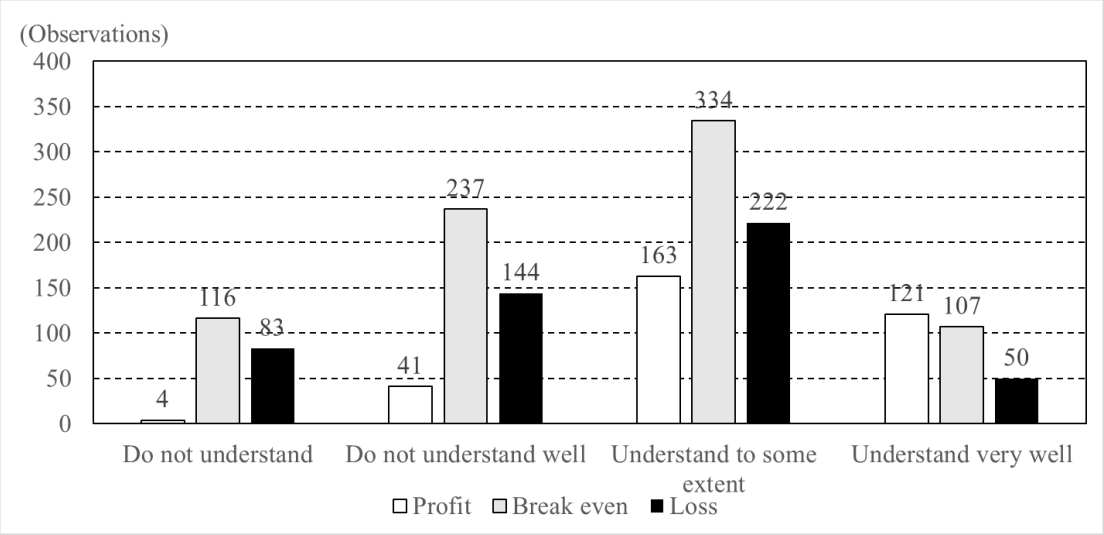

Figure 3 Use of payment methods, according to ownership of crypto assets

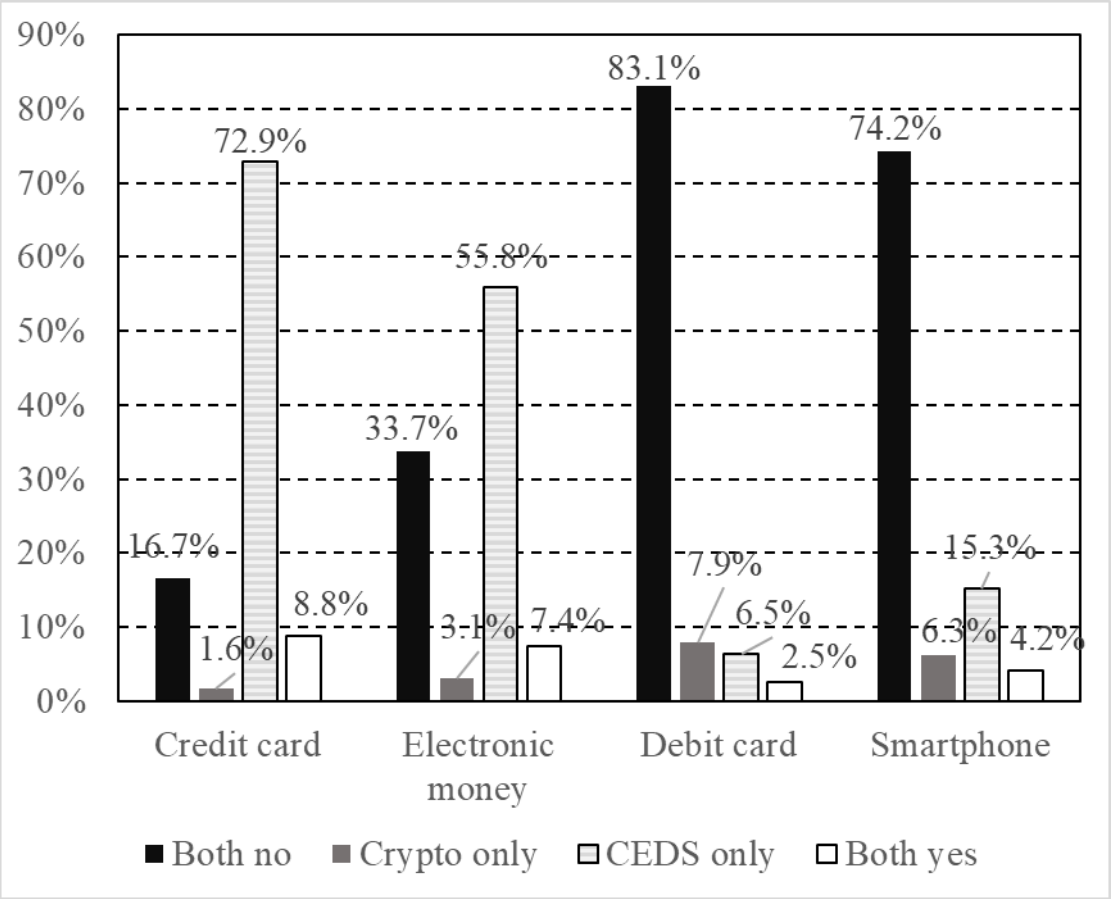

Figure 4 Use of crypto assets and payment methods by age

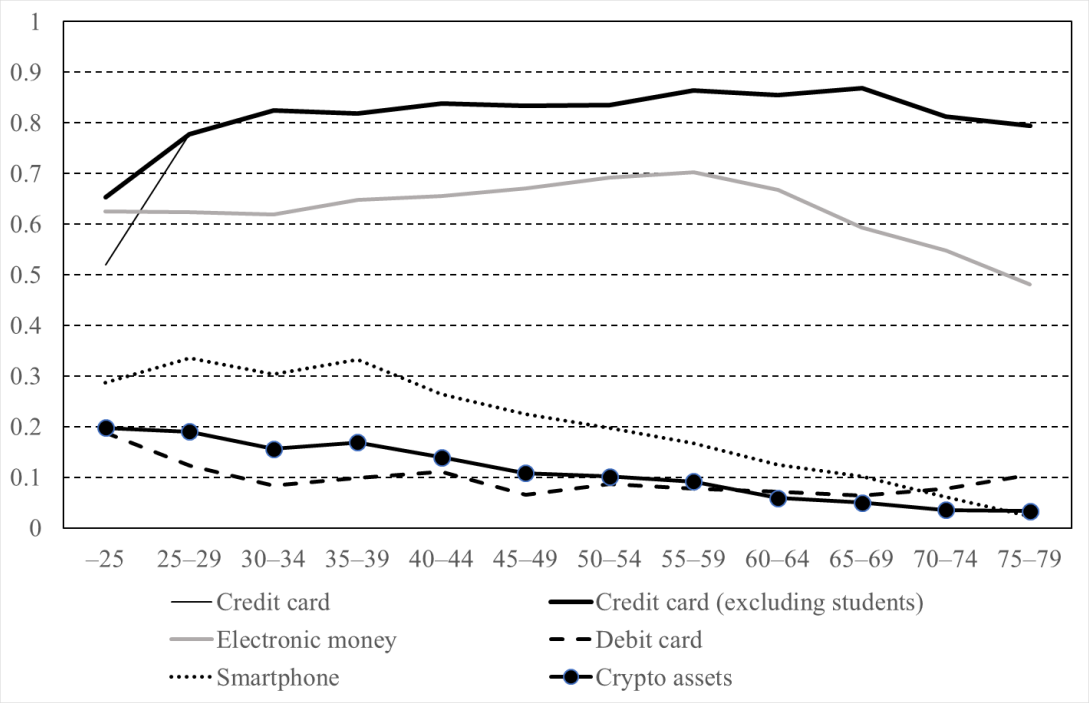

Table 1 Summary statistics

		Owners		Non-owners		Differences
		Average	S.D.	Average	S.D.	in average
Financial literacy	Crypto understand	2.661	0.904	N.A.	N.A.	
	Objective_financial_literacy	7.346	3.098	7.735	3.088	-0.389
	News	2.972	1.223	2.635	1.384	0.337
	Fin_education_school	0.212	0.409	0.084	0.277	0.128
	Fin_education_home	0.259	0.438	0.244	0.430	0.015
	Fraud1	0.131	0.337	0.063	0.243	0.068
	Debt	0.393	0.489	0.309	0.462	0.084
	Credit_card_literacy	0.435	0.496	0.584	0.493	-0.149
Financial behavior	Myopia	2.227	1.483	2.054	1.629	0.174
	Herding	1.930	1.173	1.551	1.045	0.379
	Self_control	2.935	1.003	3.001	0.979	-0.066
	Over_confidence	-5.326	3.068	-6.080	2.888	0.754
	Loss_aversion	0.455	0.498	0.724	0.447	-0.269
	Risk_aversion	0.850	0.357	0.897	0.304	-0.047
Information sources	S_fin	0.125	0.331	0.161	0.367	-0.035
	S_net	0.179	0.384	0.123	0.329	0.056
	S_fin_exp	0.293	0.455	0.154	0.361	0.140
	S_fin_net	0.155	0.362	0.263	0.440	-0.108
	S_other	0.211	0.408	0.216	0.412	-0.005
Investment experience	sif	0.460	0.499	0.142	0.349	0.318
	s_i	0.115	0.319	0.138	0.344	-0.023
	s_f	0.036	0.187	0.031	0.174	0.005
	i_f	0.023	0.151	0.034	0.181	-0.011
	s_only	0.118	0.323	0.126	0.331	-0.007
	i_only	0.035	0.184	0.078	0.267	-0.042
	f_only	0.018	0.135	0.028	0.166	-0.010
Pretax income	Income_0	0.024	0.153	0.018	0.132	0.006
	Income_250_500	0.253	0.435	0.300	0.458	-0.047
	Income_500_750	0.221	0.415	0.193	0.395	0.028
	Income_750_1000	0.141	0.348	0.114	0.318	0.027
	Income_1000_1500	0.098	0.297	0.064	0.244	0.034
	Income_1500_	0.043	0.203	0.021	0.145	0.022
	Income_NA	0.078	0.268	0.152	0.359	-0.075
Financial assets	Asset_0	0.084	0.277	0.078	0.268	0.006
	Asset_250_500	0.147	0.354	0.105	0.306	0.042
	Asset_500_750	0.094	0.292	0.055	0.228	0.039
	Asset_750_1000	0.070	0.256	0.058	0.234	0.012
	Asset_1000_2000	0.095	0.293	0.083	0.276	0.012
	Asset_2000_	0.155	0.362	0.177	0.382	-0.023
	Asset_NA	0.154	0.361	0.292	0.455	-0.139
Age	Age25_29	0.125	0.331	0.062	0.242	0.063
	Age30_34	0.112	0.315	0.070	0.256	0.041
	Age35_39	0.130	0.337	0.075	0.263	0.055
	Age40_44	0.113	0.316	0.082	0.274	0.031
	Age45_49	0.107	0.310	0.103	0.304	0.005
	Age50_54	0.079	0.270	0.081	0.274	-0.003
	Age55_59	0.075	0.263	0.086	0.281	-0.012
	Age60_64	0.065	0.246	0.120	0.325	-0.055
	Age65_69	0.046	0.209	0.101	0.302	-0.056
	Age70_74	0.039	0.195	0.125	0.331	-0.085
	Age75_79	0.015	0.121	0.050	0.218	-0.035
Gender	Male	0.713	0.452	0.471	0.499	0.243
Employment status	Private	0.538	0.499	0.318	0.466	0.221
	Public	0.054	0.225	0.031	0.173	0.023
	Teacher	0.010	0.102	0.014	0.119	-0.004
	Selfemployed	0.072	0.259	0.065	0.246	0.007
	Parttime	0.086	0.280	0.152	0.359	-0.067
	House	0.093	0.291	0.214	0.410	-0.121
	Student	0.062	0.241	0.031	0.174	0.030
Education	Seniorhigh	0.211	0.408	0.294	0.455	-0.082
	Vocationalcollege	0.097	0.296	0.103	0.304	-0.006
	Juniorcollege	0.082	0.274	0.125	0.331	-0.043
	University	0.512	0.500	0.417	0.493	0.095
	Graduate	0.076	0.265	0.043	0.204	0.033
Areas of residence	Hokkaido	0.033	0.178	0.040	0.196	-0.007
	Tohoku	0.060	0.238	0.069	0.253	-0.008
	Hokuriku	0.041	0.199	0.042	0.200	-0.001
	Chubu	0.142	0.349	0.142	0.349	0.000
	Kinki	0.159	0.366	0.169	0.375	-0.010
	Chugoku	0.062	0.241	0.058	0.233	0.004
	Shikoku	0.033	0.179	0.029	0.169	0.004
	Kyushu	0.096	0.294	0.111	0.315	-0.016
	Number of observations		1,622		13,895	

Table 2 Adoption of crypto assets (marginal effects)

		Probit	Multinomial logit				
		Holders	Understand very well	Understand to some extent	Do not understand so well	Do not understand	Do not have
Financial literacy	Objective_financial_literacy	0.004	0.001	0.008 ***	-0.001	-0.004 ***	-0.004
	News	0.004 *	0.000	0.005 ***	-0.001	0.000	-0.004 **
	Fin_education_school	0.032 ***	0.010 ***	0.015 ***	0.001	0.000	-0.026 ***
	Fin_education_home	-0.009 *	0.006 ***	-0.006	-0.004	-0.006 **	0.009 *
	Fraud1	0.043 ***	0.009 ***	0.019 ***	0.006	0.002	-0.036 ***
	Debt	0.001	0.002	0.001	-0.003	-0.002	0.002
	Credit card literacy	-0.027 ***	-0.008 ***	-0.013 ***	-0.004	-0.002	0.027 ***
Financial behavior	Myopia	0.003 **	0.000	0.002	0.001	0.000	-0.003 **
	Herding	0.013 ***	0.002 ***	0.002	0.004 ***	0.003 ***	-0.012 ***
	Self_control	-0.005 **	-0.001	-0.001	-0.003 **	0.000	0.005 **
	Over_confidence	0.010 ***	0.004 ***	0.009 ***	0.000	-0.002 **	-0.010 ***
	Loss_aversion	-0.031 ***	-0.004	-0.011 ***	-0.010 ***	-0.004 **	0.029 ***
	Risk_aversion	0.004	0.000	-0.001	0.009 **	-0.002	-0.007
Information sources	S_fin	0.033 ***	0.028 ***	0.001	0.012	-0.001	-0.039 ***
	S_net	0.048 ***	0.018 *	0.025 **	0.014 *	0.001	-0.057 ***
	S_fin_exp	0.070 ***	0.027 ***	0.034 ***	0.020 ***	-0.003	-0.077 ***
	S_fin_net	0.022 **	0.013	0.016	0.004	-0.002	-0.031 **
	S_other	0.031 ***	0.014	0.019 *	0.014 *	-0.005	-0.041 ***
Investment experience	sif	0.146 ***	0.035 ***	0.056 ***	0.031 ***	0.017 ***	-0.139 ***
	s_i	0.062 ***	0.017 ***	0.028 ***	0.015 ***	0.005	-0.065 ***
	s_f	0.087 ***	0.026 ***	0.024 **	0.029 ***	0.009	-0.087 ***
	i_f	0.046 ***	0.020 ***	0.014	0.007	0.007	-0.048 ***
	s_only	0.063 ***	0.024 ***	0.018 ***	0.011 **	0.012 ***	-0.065 ***
	i_only	0.017	-0.011	0.017 *	0.004	0.001	-0.011
	f_only	0.033 *	-0.001	0.011	0.014	0.006	-0.030 *
Pretax income	Income_0	-0.001	0.000	-0.018	-0.005	0.011 **	0.012
	Income_250_500	-0.020 **	-0.003	0.002	-0.013 ***	-0.003	0.016 **
	Income_500_750	-0.010	-0.002	0.000	-0.006	-0.001	0.009
	Income_750_1000	-0.011	0.001	-0.001	-0.011 **	0.000	0.011
	Income_1000_1500	0.007	0.000	0.006	-0.003	0.005	-0.007
	Income_1500_	0.033 **	0.006	0.023 *	0.003	-0.003	-0.028 *
	Income_NA	-0.023 **	-0.001	-0.013	-0.001	-0.006	0.021 *
Financial assets	Asset_0	0.000	0.001	0.004	-0.011 *	0.005	0.001
	Asset_250_500	-0.005	0.008 **	-0.005	-0.004	-0.004	0.004
	Asset_500_750	0.005	0.007 **	-0.003	0.001	0.000	-0.005
	Asset_750_1000	-0.016	0.011 ***	-0.018 **	0.000	-0.006	0.012
	Asset_1000_2000	-0.015	0.004	-0.008	-0.005	-0.006	0.015
	Asset_2000_	-0.043 ***	0.003	-0.021 ***	-0.015 **	-0.005	0.038 ***
	Asset_NA	-0.037 ***	-0.001	-0.017 ***	-0.015 ***	-0.002	0.036 ***
Age	Age25_29	-0.014	-0.005	-0.002	-0.001	-0.007	0.016
	Age30_34	-0.030 *	-0.012 **	0.002	-0.014	-0.007	0.030 **
	Age35_39	-0.034 **	-0.008 *	-0.006	-0.009	-0.010 *	0.034 **
	Age40_44	-0.047 ***	-0.009 *	-0.012	-0.019 **	-0.006	0.045 ***
	Age45_49	-0.071 ***	-0.016 ***	-0.027 ***	-0.017 *	-0.009 *	0.069 ***
	Age50_54	-0.074 ***	-0.018 ***	-0.031 ***	-0.018 **	-0.006	0.072 ***
	Age55_59	-0.081 ***	-0.017 ***	-0.031 ***	-0.029 ***	-0.004	0.080 ***
	Age60_64	-0.115 ***	-0.021 ***	-0.059 ***	-0.028 ***	-0.008	0.116 ***
	Age65_69	-0.123 ***	-0.026 ***	-0.051 ***	-0.035 ***	-0.012 **	0.124 ***
	Age70_74	-0.154 ***	-0.036 ***	-0.080 ***	-0.032 ***	-0.011 *	0.159 ***
	Age75_79	-0.156 ***	-0.045 ***	-0.053 ***	-0.042 ***	-0.023 **	0.162 ***
Gender	Male	0.032 ***	0.008 ***	0.020 ***	0.004	0.000	-0.031 ***
Employment status	Private	0.021 **	-0.008 **	0.012	0.010	0.007 *	-0.020 *
	Public	0.023 *	-0.011 *	0.024 **	-0.003	0.006	-0.016
	Teacher	-0.029	-0.005	-0.031	-0.006	-0.001	0.043 *
	Selfemployed	0.022 **	-0.008 *	0.025 ***	0.003	-0.004	-0.016
	Parttime	0.000	-0.013 ***	0.003	0.006	0.002	0.003
	House	0.018 *	-0.005	0.003	0.012 *	0.002	-0.012
	Student	0.000	-0.007	0.018	-0.004	-0.008	0.000
Education	Seniorhigh	-0.034 **	-0.004	-0.026 **	-0.002	-0.005	0.036 ***
	Vocationalcollege	-0.037 **	0.000	-0.026 **	-0.009	-0.006	0.040 ***
	Juniorcollege	-0.024	-0.001	-0.026 **	-0.001	0.000	0.028 *
	University	-0.027 *	-0.002	-0.026 ***	0.004	-0.004	0.029 **
	Graduate	-0.013	0.000	-0.023 *	0.007	-0.002	0.018
	N	15517					15517
	Pseudo-R2	0.23					0.219
	LLR	-4001.2					-5675.2

Note: Parameter estimates for areas of residence are not reported.

Table 3 Profitability of investment in crypto assets (marginal effects)

		Multinomial logit		
		Profit	Break even	Loss
Financial literacy	Crypto_understand	0.113 ***	-0.083 ***	-0.030 **
	Objective_financial_literacy	0.011	-0.001	-0.010
	News	0.041 ***	-0.028 **	-0.012
	Fin_education_school	0.006	0.081 **	-0.087 ***
	Fin_education_home	0.088 ***	-0.024	-0.064 **
	Fraud1	0.044 *	-0.065 *	0.021
	Debt	0.004	-0.051 **	0.047 **
	Credit card literacy	-0.008	-0.059 **	0.067 ***
Financial behavior	Myopia	0.005	-0.007	0.002
	Herding	-0.002	-0.014	0.016
	Self_control	0.008	0.016	-0.024 **
	Over_confidence	0.012	0.006	-0.018
	Loss_aversion	-0.012	0.044	-0.031
	Risk_aversion	-0.034	0.091 **	-0.058 *
Information sources	S_fin	0.030	0.033	-0.063
	S_net	0.036	-0.016	-0.020
	S_fin_exp	0.065	0.017	-0.083
	S_fin_net	0.013	0.107	-0.120 *
	S_other	0.041	0.034	-0.076
Investment experience	sif	0.024	0.073 **	-0.097 ***
	s_i	0.025	-0.005	-0.020
	s_f	0.081 *	0.010	-0.091
	i_f	-0.215 **	0.151	0.063
	s_only	0.039	-0.035	-0.004
	i_only	-0.018	0.054	-0.036
	f_only	-0.011	-0.113	0.124
Pretax income	Income_0	-0.019	0.026	-0.007
	Income_250_500	-0.018	0.007	0.010
	Income_500_750	-0.001	-0.014	0.014
	Income_750_1000	0.006	0.078	-0.084 *
	Income_1000_1500	0.038	-0.033	-0.005
	Income_1500_	0.167 ***	-0.031	-0.136 *
	Income_NA	0.030	-0.120 *	0.090
Financial assets	Asset_0	-0.025	0.089 *	-0.065
	Asset_250_500	-0.034	0.059	-0.025
	Asset_500_750	-0.001	0.049	-0.048
	Asset_750_1000	-0.041	0.117 **	-0.075
	Asset_1000_2000	-0.022	0.146 ***	-0.124 **
	Asset_2000_	-0.019	0.096 *	-0.078 *
	Asset_NA	-0.007	0.053	-0.046
Age	Age25_29	0.050	-0.020	-0.030
	Age30_34	0.088 *	-0.087	-0.001
	Age35_39	-0.002	0.003	-0.002
	Age40_44	-0.044	0.057	-0.013
	Age45_49	-0.005	0.000	0.006
	Age50_54	-0.023	-0.022	0.045
	Age55_59	-0.026	0.034	-0.008
	Age60_64	-0.095	-0.034	0.129 *
	Age65_69	-0.048	-0.037	0.085
	Age70_74	-0.072	-0.035	0.106
	Age75_79	-0.058	-0.057	0.115
Gender	Male	0.023	0.012	-0.036
Employment status	Private	-0.079 **	0.042	0.037
	Public	-0.069	0.039	0.030
	Teacher	-0.010	0.034	-0.024
	Selfemployed	-0.024	-0.002	0.026
	Parttime	-0.006	0.062	-0.056
	House	0.017	0.008	-0.025
	Student	0.086	0.028	-0.114
Education	Seniorhigh	0.074	0.026	-0.100
	Vocationalcollege	0.083	-0.029	-0.054
	Juniorcollege	-0.027	0.067	-0.039
	University	0.065	0.045	-0.109
	Graduate	0.087	0.007	-0.094
	N			1622
	Pseudo-R2			0.143
	LLR			-1440.63

Note: Parameter estimates for areas of residence are not reported.

Table 4 Comparison with the adoption of other risky assets (marginal effects)

		Crypto assets		sif		s_i		s_f		i_f		s_only		i_only		f_only	
Financial literacy	Objective_financial_literacy	0.015	***	0.059	***	0.019	***	0.001		0.007	***	-0.001		0.002		-0.003	*
	News	0.009	***	0.025	***	0.015	***	0.004	***	-0.001		0.008	***	-0.005	***	-0.001	
	Fin_education_school	0.046	***	0.056	***	0.006		-0.010	*	0.005		0.003		-0.009		0.000	
	Fin_education_home	-0.013	**	-0.016	**	-0.013	**	-0.001		-0.005		0.014	**	-0.006		-0.002	
	Fraud1	0.046	***	0.032	***	-0.015		0.001		0.003		-0.035	***	-0.012		0.007	
	Debt	-0.002		-0.012	*	-0.010		-0.002		-0.001		0.007		-0.006		-0.001	
	Credit_card literacy	-0.034	***	-0.029	***	0.003		0.001		0.004		-0.010	*	0.005		0.003	
Financial behavior	Myopia	0.004	***	0.001		-0.001		0.001		-0.003	***	0.003	*	-0.003	**	0.000	
	Herding	0.017	***	0.023	***	0.005	**	-0.003	**	0.000		-0.006	**	-0.003		-0.002	*
	Self_control	-0.008	***	-0.017	***	-0.002		-0.001		-0.002		-0.002		-0.001		0.000	
	Over_confidence	0.021	***	0.057	***	0.010	***	0.000		0.005	***	-0.001		-0.003		-0.003	**
	Loss_aversion	-0.051	***	-0.087	***	-0.049	***	-0.006	*	-0.005		0.011	*	0.000		0.007	**
	Risk_aversion	-0.001		-0.021	***	-0.022	***	-0.006		0.000		-0.006		-0.003		0.001	
Information sources	S_fin	0.052	***	0.116	***	0.017		0.016	*	0.056	***	-0.025	*	0.084	***	0.024	***
	S_net	0.070	***	0.101	***	0.039	**	0.037	***	0.031	***	0.079	***	0.033	***	0.031	***
	S_fin_exp	0.100	***	0.161	***	0.029	*	0.019	**	0.040	***	-0.002		0.041	***	0.017	**
	S_fin_net	0.037	***	0.099	***	0.020		0.022	**	0.041	***	0.009		0.046	***	0.020	***
	S_other	0.049	***	0.078	***	0.013		0.037	***	0.018	*	0.091	***	0.006		0.022	***
Pretax income	Income_0	-0.001		0.004		0.022		0.012		-0.009		-0.051	**	0.006		-0.018	
	Income_250_500	-0.025	***	-0.042	***	0.008		0.001		-0.006		0.001		0.006		0.001	
	Income_500_750	-0.017	*	-0.035	***	0.000		-0.004		-0.014	**	0.005		0.004		0.000	
	Income_750_1000	-0.016	*	-0.030	**	0.003		-0.002		-0.014	**	0.015		0.001		0.000	
	Income_1000_1500	0.002		-0.038	***	0.010		0.000		-0.014	**	0.008		-0.004		0.001	
	Income_1500_	0.033	**	0.004		-0.011		0.012		-0.031	***	0.003		-0.005		-0.019	*
	Income_NA	-0.020	*	0.000		0.000		0.005		-0.007		0.017		-0.003		-0.007	
Financial assets	Asset_0	-0.008		-0.022		-0.090	***	-0.016	*	-0.004		-0.031	**	-0.060	***	-0.021	***
	Asset_250_500	0.004		0.053	***	0.000		0.000		0.013	**	-0.002		-0.001		-0.005	
	Asset_500_750	0.016	*	0.054	***	0.025	*	-0.005		0.019	***	0.003		0.006		-0.003	
	Asset_750_1000	-0.001		0.065	***	0.039	***	0.006		0.018	**	-0.001		-0.009		-0.007	
	Asset_1000_2000	0.003		0.073	***	0.041	***	0.000		0.024	***	-0.008		-0.006		0.000	
	Asset_2000_	-0.018	**	0.121	***	0.029	***	-0.002		0.023	***	-0.054	***	-0.020	**	-0.008	
	Asset_NA	-0.040	***	0.015		0.018	*	-0.008		0.015	***	-0.024	**	-0.013		0.003	
Age	Age25_29	-0.021		-0.047	**	0.047		-0.007		0.040	***	-0.014		0.003		0.002	
	Age30_34	-0.033	**	-0.044	*	0.054	*	-0.001		0.053	***	0.021		0.009		0.009	
	Age35_39	-0.033	**	-0.028		0.060	**	0.019		0.050	***	0.018		0.029		0.011	
	Age40_44	-0.044	***	-0.015		0.082	***	0.018		0.050	***	0.018		0.018		0.012	
	Age45_49	-0.067	***	-0.015		0.066	**	0.028	*	0.053	***	0.053	**	0.004		0.020	
	Age50_54	-0.067	***	-0.002		0.056	**	0.038	**	0.058	***	0.051	**	0.020		0.011	
	Age55_59	-0.075	***	-0.006		0.086	***	0.034	**	0.055	***	0.061	***	0.011		0.017	
	Age60_64	-0.107	***	-0.003		0.112	***	0.029	*	0.057	***	0.086	***	0.009		0.013	
	Age65_69	-0.113	***	0.005		0.146	***	0.032	**	0.045	***	0.083	***	0.035	*	0.015	
	Age70_74	-0.143	***	0.000		0.160	***	0.024		0.036	***	0.110	***	0.024		0.008	
	Age75_79	-0.148	***	-0.025		0.200	***	0.037	**	0.033	***	0.122	***	0.016		0.005	
Gender	Male	0.043	***	0.012		0.017	**	0.013	***	-0.015	***	0.064	***	-0.035	***	-0.007	**
Employment status	Private	0.029	***	0.027	***	0.012		0.005		-0.002		0.015	*	0.009		0.009	*
	Public	0.030	**	0.040	**	-0.002		0.011		-0.009		-0.016		0.026	**	0.006	
	Teacher	-0.036		-0.022		0.026		-0.028	*	0.000		-0.036		0.030	*	0.030	***
	Selfemployed	0.030	**	0.033	***	-0.007		0.005		-0.022	***	0.028	**	-0.021	*	0.010	
	Parttime	0.001		-0.014		0.007		0.013	**	-0.012	**	0.009		0.001		0.000	
	House	0.022	**	0.000		0.008		0.014	**	-0.009	**	0.013		-0.001		0.001	
	Student	-0.007		-0.028		-0.027		-0.011		0.013		-0.037		-0.072	**	0.015	
Education	Seniorhigh	-0.033	**	0.002		-0.020		0.020		-0.001		0.034	*	0.012		0.000	
	Vocationalcollege	-0.031	*	0.026		-0.006		0.024		-0.008		0.015		0.014		0.007	
	Juniorcollege	-0.015		0.046	*	-0.003		0.023		-0.002		0.024		0.012		0.009	
	University	-0.021		0.025		-0.002		0.029	*	-0.002		0.028		0.018		0.005	
	Graduate	0.000		0.062	**	-0.012		0.042	**	-0.007		0.020		0.011		0.006	
	N	15517		15517		15517		15517		15517		15517		15517		15517	
	Pseudo-R2	0.183		0.193		0.104		0.076		0.065		0.071		0.059		0.035	
	LLR	-4244.37		-5812.48		-5503.44		-2015.91		-2097.5		-5426.98		-3817.73		-1872.78	

Note: Parameter estimates for areas of residence are not reported.

Table 5 Crypto asset owners—With or without having invested in stocks, investment trusts, and foreign currency denominated deposits and MMFs

		sif owners within crypto owners	
		Marginal effects	
Financial literacy	Objective_financial_literacy	0.059	***
	News	0.056	***
	Fin_education_school	0.128	***
	Fin_education_home	0.002	
	Fraud1	0.046	
	Debt	-0.027	
	Credit_card literacy	-0.070	***
Financial behavior	Myopia	-0.001	
	Herding	0.038	***
	Self_control	-0.025	**
	Over_confidence	0.067	***
	Loss_aversion	-0.083	***
	Risk_aversion	0.017	
Information sources	S_fin	0.275	***
	S_net	0.224	***
	S_fin_exp	0.338	***
	S_fin_net	0.250	***
	S_other	0.170	**
Pretax income	Income_0	0.036	
	Income_250_500	-0.014	
	Income_500_750	-0.039	
	Income_750_1000	-0.021	
	Income_1000_1500	-0.020	
	Income_1500_	-0.033	
	Income_NA	0.098	
Financial assets	Asset_0	-0.018	
	Asset_250_500	0.103	***
	Asset_500_750	0.100	**
	Asset_750_1000	0.079	*
	Asset_1000_2000	0.101	**
	Asset_2000_	0.224	***
	Asset_NA	-0.035	
Age	Age25_29	-0.096	
	Age30_34	-0.058	
	Age35_39	-0.039	
	Age40_44	-0.095	
	Age45_49	-0.062	
	Age50_54	-0.015	
	Age55_59	-0.048	
	Age60_64	-0.092	
	Age65_69	-0.081	
	Age70_74	-0.034	
	Age75_79	-0.063	
Gender	Male	0.066	**
Employment status	Private	0.003	
	Public	0.046	
	Teacher	-0.043	
	Selfemployed	0.040	
	Parttime	-0.061	
	House	0.042	
	Student	-0.059	
Education	Seniorhigh	-0.039	
	Vocationalcollege	0.017	
	Juniorcollege	-0.040	
	University	-0.031	
	Graduate	-0.014	
	N	1622	
	Pseudo-R2	0.185	
	LLR	-911.982	

Note: Parameter estimates for areas of residence are not reported.

Table 6 Comparison with credit card payments (marginal effects)

		Credit cards								Credit cards	
		Both no		Crypt only		Credit only		Both yes		within Crypto	
Financial literacy	Objective_financial_literacy	-0.024	***	-0.002		0.019	***	0.006	**	0.023	**
	News	-0.005	**	-0.002	*	0.001		0.005	***	0.015	**
	Fin_education_school	0.006		0.010	***	-0.037	***	0.021	***	-0.041	*
	Fin_education_home	0.005		-0.007	**	0.003		-0.002		0.028	
	Fraud1	0.065	***	0.013	***	-0.103	***	0.026	***	0.009	
	Debt	-0.035	***	-0.005	**	0.036	***	0.003		-0.007	
	Credit_card literacy	-0.023	***	-0.002		0.050	***	-0.025	***	0.018	***
Financial behavior	Myopia	0.004	**	0.001		-0.007	***	0.002	*	-0.003	
	Herding	-0.001		0.000		-0.011	***	0.012	***	0.014	
	Self_control	0.010	***	0.000		-0.005		-0.004	**	-0.007	
	Over_confidence	-0.016	***	0.001		0.006		0.010	***	-0.062	**
	Loss_aversion	0.019	**	-0.007	***	0.010		-0.023	***	0.036	**
	Risk_aversion	-0.014		0.003		0.009		0.002		-0.006	
Information sources	S_fin	-0.002		0.001		-0.031	**	0.032	**	0.068	
	S_net	-0.048	***	0.009	*	0.004		0.035	***	0.022	
	S_fin_exp	-0.022	*	0.014	***	-0.045	***	0.053	***	0.014	
	S_fin_net	-0.025	**	0.002		0.006		0.017		0.032	
	S_other	-0.017	*	0.007		-0.012		0.022	*	0.013	
Investment experience	sif	-0.092	***	0.015	***	-0.049	***	0.126	***	0.089	***
	s_i	-0.054	***	0.008	*	-0.011		0.058	***	0.042	
	s_f	-0.096	***	0.019	***	0.005		0.072	***	-0.025	
	i_f	-0.072	***	0.001		0.025		0.046	***	0.102	
	s_only	-0.041	***	0.013	***	-0.021	*	0.049	***	-0.011	
	i_only	-0.037	***	0.000		0.020		0.018		0.035	
	f_only	-0.054	***	0.012	**	0.024		0.019		-0.094	**
Pretax income	Income_0	0.035	*	0.005		-0.034		-0.006		-0.036	
	Income_250_500	0.004		0.000		0.013		-0.017	**	-0.035	
	Income_500_750	-0.030	***	0.001		0.038	***	-0.009		-0.025	
	Income_750_1000	-0.026	**	0.001		0.036	**	-0.011		-0.035	
	Income_1000_1500	-0.014		0.000		0.008		0.006		0.004	
	Income_1500_	-0.039		0.001		0.008		0.029	**	0.024	
	Income_NA	0.027	**	-0.004		-0.008		-0.014		0.020	
Financial assets	Asset_0	0.056	***	0.004		-0.060	***	0.000		-0.023	
	Asset_250_500	0.010		0.000		-0.007		-0.003		0.008	
	Asset_500_750	-0.029	*	-0.003		0.024		0.008		0.058	
	Asset_750_1000	-0.025	*	-0.010	*	0.038	**	-0.002		0.082	**
	Asset_1000_2000	-0.037	***	-0.008	*	0.051	***	-0.006		0.066	*
	Asset_2000_	-0.021	*	-0.015	***	0.062	***	-0.026	***	0.076	**
	Asset_NA	0.008		-0.002		0.029	**	-0.035	***	-0.019	
Age	Age25_29	-0.033		-0.014	**	0.051	**	-0.005		0.090	**
	Age30_34	-0.057	***	-0.012	**	0.090	***	-0.021		0.065	
	Age35_39	-0.038	*	-0.011	**	0.074	***	-0.025	*	0.030	
	Age40_44	-0.057	***	-0.010	*	0.106	***	-0.039	***	0.026	
	Age45_49	-0.041	*	-0.012	**	0.115	***	-0.062	***	0.001	
	Age50_54	-0.039	*	-0.014	**	0.116	***	-0.063	***	0.030	
	Age55_59	-0.061	***	-0.009		0.144	***	-0.074	***	-0.033	
	Age60_64	-0.036	*	-0.027	***	0.157	***	-0.094	***	0.066	
	Age65_69	-0.062	***	-0.038	***	0.195	***	-0.096	***	0.134	**
	Age70_74	-0.009		-0.026	***	0.170	***	-0.135	***	0.009	
	Age75_79	-0.006		-0.037	***	0.171	***	-0.128	***	0.093	
Gender	Male	0.051	***	0.012	***	-0.083	***	0.020	***	-0.050	**
Employment status	Private	-0.040	***	-0.004		0.019		0.025	***	0.062	*
	Public	-0.047	**	-0.006		0.025		0.028	**	0.071	
	Teacher	-0.022		-0.010		0.053		-0.021		0.028	
	Selfemployed	-0.025	*	-0.001		0.004		0.022	**	0.039	
	Parttime	0.010		-0.003		-0.010		0.004		0.020	
	House	-0.004		0.003		-0.012		0.012		-0.026	
	Student	0.090	***	0.000		-0.105	***	0.015		-0.007	
Education	Seniorhigh	-0.034	**	-0.004		0.077	***	-0.039	***	0.003	
	Vocationalcollege	-0.056	***	-0.007		0.103	***	-0.040	***	0.045	
	Juniorcollege	-0.082	***	-0.009		0.117	***	-0.026	*	0.081	
	University	-0.095	***	-0.010	*	0.131	***	-0.026	*	0.065	
	Graduate	-0.124	***	-0.009		0.148	***	-0.015		0.085	
Areas of residence	Hokkaido	0.011		0.000		-0.009		-0.001		-0.021	
	Tohoku	0.020	*	0.001		-0.015		-0.006		-0.031	
	Hokuriku	0.027		0.003		-0.022		-0.008		-0.034	
	Chubu	0.001		0.001		0.000		-0.002		-0.002	
	Kinki	0.007		-0.005		0.001		-0.004		0.031	
	Chugoku	0.022	*	0.003		-0.031	*	0.006		-0.001	
	Shikoku	0.034	**	0.008		-0.052	***	0.010		-0.023	
	Kyushu	0.029	***	-0.002		-0.024	*	-0.003		0.008	
	N							15517		1622	
	Pseudo-R2							0.175		0.174	
	LLR							-10400		-582.52	

Table 7 Comparison with electronic money payments (marginal effects)

		Emoney								Emoney	
		Both no		Crypt only		Emoney only		Both yes		within Crypto	
Financial literacy	Objective_financial_literacy	-0.019	***	0.000		0.015	***	0.005	*	0.019	
	News	-0.016	***	-0.003	**	0.012	***	0.007	***	0.034	***
	Fin_education_school	-0.020		0.010	***	-0.011		0.021	***	0.008	
	Fin_education_home	-0.007		-0.009	***	0.016	*	0.000		0.040	
	Fraud1	-0.026		0.010	**	-0.013		0.030	***	0.002	
	Debt	0.002		-0.004		0.000		0.002		-0.006	
	Credit_card literacy	-0.007		-0.012	***	0.034	***	-0.015	***	0.004	
Financial behavior	Myopia	0.005	**	0.001		-0.008	***	0.002		-0.006	
	Herding	-0.001		0.003	**	-0.011	***	0.009	***	-0.010	
	Self_control	0.015	***	-0.001		-0.010	**	-0.004	**	0.021	
	Over_confidence	-0.009	*	0.003	*	-0.002		0.007	***	0.043	
	Loss_aversion	0.026	***	-0.008	**	0.004		-0.022	***	0.017	
	Risk_aversion	-0.009		0.000		0.005		0.005		0.038	
Information sources	S_fin	0.002		0.004		-0.036	**	0.029	***	0.073	
	S_net	0.004		0.025	***	-0.049	**	0.020	*	-0.068	
	S_fin_exp	-0.028	*	0.027	***	-0.040	**	0.041	***	-0.010	
	S_fin_net	-0.018		0.006		-0.001		0.014		0.040	
	S_other	0.004		0.016	**	-0.034	*	0.014		-0.012	
Investment experience	sif	-0.123	***	0.040	***	-0.019		0.102	***	0.047	
	s_i	-0.077	***	0.024	***	0.012		0.042	***	-0.017	
	s_f	-0.096	***	0.025	***	0.007		0.064	***	0.032	
	i_f	-0.071	***	0.019	**	0.024		0.029	**	-0.006	
	s_only	-0.045	***	0.024	***	-0.018		0.040	***	-0.033	
	i_only	-0.021		-0.003		0.004		0.021	**	0.091	
	f_only	-0.087	***	0.013		0.052	**	0.022		-0.019	
Pretax income	Income_0	0.062	**	0.012		-0.052		-0.023		-0.120	
	Income_250_500	0.002		-0.006		0.014		-0.010		0.006	
	Income_500_750	-0.009		-0.005		0.018		-0.003		0.032	
	Income_750_1000	-0.036	**	-0.004		0.046	***	-0.006		0.020	
	Income_1000_1500	-0.050	**	0.004		0.042	**	0.005		0.000	
	Income_1500_	-0.069	**	0.003		0.038		0.028	**	0.043	
	Income_NA	0.015		-0.015	**	0.004		-0.004		0.087	
Financial assets	Asset_0	0.017		0.003		-0.017		-0.002		-0.027	
	Asset_250_500	0.014		0.003		-0.010		-0.007		-0.040	
	Asset_500_750	0.022		0.001		-0.026		0.003		0.005	
	Asset_750_1000	0.008		-0.005		0.004		-0.006		0.028	
	Asset_1000_2000	-0.001		-0.012	*	0.017		-0.004		0.048	
	Asset_2000_	0.026		-0.013	**	0.014		-0.027	***	0.008	
	Asset_NA	0.026	*	-0.004		0.012		-0.033	***	-0.072	*
Age	Age25_29	0.012		-0.001		0.006		-0.016		-0.068	
	Age30_34	0.040		-0.005		-0.009		-0.027	**	-0.048	
	Age35_39	0.021		-0.006		0.014		-0.029	**	-0.056	
	Age40_44	0.020		-0.009		0.028		-0.039	***	-0.052	
	Age45_49	0.023		-0.019	**	0.049		-0.054	***	-0.041	
	Age50_54	0.003		-0.021	**	0.072	**	-0.054	***	0.005	
	Age55_59	0.005		-0.020	**	0.077	**	-0.062	***	-0.033	
	Age60_64	0.042		-0.024	**	0.076	**	-0.095	***	-0.120	*
	Age65_69	0.103	***	-0.031	***	0.026		-0.098	***	-0.077	
	Age70_74	0.151	***	-0.040	***	0.008		-0.119	***	-0.073	
	Age75_79	0.195	***	-0.035	***	-0.034		-0.126	***	-0.131	
Gender	Male	0.041	***	0.011	***	-0.073	***	0.020	***	-0.020	
Employment status	Private	-0.050	***	0.000		0.029	*	0.021	**	0.062	
	Public	-0.067	**	-0.002		0.045		0.024	*	0.098	
	Teacher	-0.016		-0.012		0.047		-0.018		0.093	
	Selfemployed	-0.002		0.004		-0.020		0.018		0.023	
	Parttime	-0.040	***	-0.008		0.040	**	0.009		0.062	
	House	-0.015		0.000		-0.002		0.017		0.040	
	Student	-0.084	**	-0.012		0.082	**	0.013		0.097	
Education	Seniorhigh	-0.022		-0.018	**	0.056	*	-0.016		0.101	
	Vocationalcollege	-0.045	*	-0.021	***	0.083	***	-0.017		0.136	*
	Juniorcollege	-0.049	*	-0.017	**	0.074	**	-0.008		0.138	*
	University	-0.071	***	-0.020	**	0.098	***	-0.007		0.140	*
	Graduate	-0.130	***	-0.019	*	0.144	***	0.004		0.175	**
Areas of residence	Hokkaido	0.069	***	0.008		-0.067	***	-0.010		-0.106	*
	Tohoku	0.061	***	0.007		-0.057	***	-0.011		-0.082	
	Hokuriku	0.161	***	0.020	***	-0.155	***	-0.027	**	-0.221	***
	Chubu	0.108	***	0.012	***	-0.107	***	-0.014	**	-0.129	***
	Kinki	0.138	***	0.006		-0.131	***	-0.013	***	-0.085	***
	Chugoku	0.071	***	0.007		-0.081	***	0.002		-0.017	
	Shikoku	0.107	***	0.015	**	-0.125	***	0.004		-0.055	
	Kyushu	0.091	***	0.014	***	-0.083	***	-0.022	***	-0.164	***
	N							15517		1622	
	Pseudo-R2							0.121		0.097	
	LLR							-13500		-889.37	

Note: Emoney stands for electronic money.

Table 8 Comparison with debit card payments (marginal effects)

		Debit card				Debit
		Both no	Crypt only	Debit only	Both yes	within Crypto
Financial literacy	Objective_financial_literacy	-0.005	0.004	0.000	0.001	-0.002
	News	-0.010 ***	0.001	0.006 ***	0.002 **	0.022 **
	Fin_education_school	-0.039 ***	0.014 **	0.011	0.014 ***	0.073 ***
	Fin_education_home	0.001	-0.010 **	0.008	0.002	0.031
	Fraud1	-0.066 ***	0.013 *	0.032 ***	0.022 ***	0.014
	Debt	0.017 **	-0.006	-0.015 ***	0.004 *	0.012 *
	Credit_card literacy	0.026 ***	-0.020 ***	0.001	-0.006 ***	0.012
Financial behavior	Myopia	-0.006 ***	0.002	0.003 **	0.001	0.017 *
	Herding	-0.012 ***	0.008 ***	0.000	0.004 ***	-0.042 **
	Self_control	0.008 ***	-0.005 ***	-0.003	0.000	0.014
	Over_confidence	-0.010 ***	0.007 **	0.000	0.004 ***	0.153 ***
	Loss_aversion	0.041 ***	-0.019 ***	-0.012 ***	-0.010 ***	0.034
	Risk_aversion	0.002	0.001	-0.005	0.003	-0.005
Information sources	S_fin	-0.027 *	0.021 *	-0.008	0.013 *	0.056
	S_net	-0.061 ***	0.034 ***	0.015	0.013	0.065
	S_fin_exp	-0.079 ***	0.050 ***	0.010	0.019 **	0.066
	S_fin_net	-0.021 *	0.013	0.000	0.009	0.049
	S_other	-0.045 ***	0.025 **	0.013	0.007	0.030
Investment experien	sif	-0.138 ***	0.099 ***	-0.002	0.041 ***	0.112 ***
	s_i	-0.056 ***	0.054 ***	-0.008	0.010 **	-0.032
	s_f	-0.106 ***	0.064 ***	0.017	0.025 ***	0.077
	i_f	-0.071 ***	0.029 **	0.022 **	0.019 **	0.063
	s_only	-0.061 ***	0.055 ***	-0.001	0.007	-0.045
	i_only	-0.021	0.016	0.003	0.002	-0.024
	f_only	-0.064 ***	0.039 ***	0.034 ***	-0.009	-0.146
Pretax income	Income_0	0.027	0.005	-0.023 *	-0.009	-0.081
	Income_250_500	0.023 **	-0.018 **	-0.006	0.001	0.036
	Income_500_750	0.022 **	-0.005	-0.012 *	-0.004	-0.016
	Income_750_1000	0.019	-0.007	-0.007	-0.005	-0.029
	Income_1000_1500	0.003	0.004	-0.008	0.001	0.010
	Income_1500_	-0.020	0.007	-0.005	0.018 ***	0.143 ***
	Income_NA	0.019	-0.015	0.003	-0.008	-0.038
Financial assets	Asset_0	-0.029 ***	-0.001	0.027 ***	0.003	0.020
	Asset_250_500	0.010	-0.006	-0.005	0.001	0.001
	Asset_500_750	0.011	-0.003	-0.014	0.007 *	0.055
	Asset_750_1000	0.028 **	-0.015	-0.017	0.003	0.034
	Asset_1000_2000	0.028 **	-0.017 *	-0.013	0.002	0.041
	Asset_2000_	0.053 ***	-0.039 ***	-0.013	0.000	0.049
	Asset_NA	0.048 ***	-0.032 ***	-0.013 *	-0.003	0.024
Age	Age25_29	0.036	-0.006	-0.021	-0.009 *	-0.053
	Age30_34	0.065 ***	-0.011	-0.036 **	-0.018 ***	-0.125 **
	Age35_39	0.061 ***	-0.017	-0.029 *	-0.015 **	-0.075
	Age40_44	0.056 ***	-0.030 **	-0.011	-0.015 ***	-0.050
	Age45_49	0.111 ***	-0.040 ***	-0.041 ***	-0.030 ***	-0.142 ***
	Age50_54	0.095 ***	-0.047 ***	-0.023	-0.025 ***	-0.096
	Age55_59	0.105 ***	-0.049 ***	-0.025	-0.030 ***	-0.142 **
	Age60_64	0.142 ***	-0.082 ***	-0.027 *	-0.034 ***	-0.100
	Age65_69	0.161 ***	-0.083 ***	-0.035 **	-0.043 ***	-0.172 ***
	Age70_74	0.177 ***	-0.115 ***	-0.020	-0.042 ***	-0.117 *
	Age75_79	0.159 ***	-0.111 ***	0.000	-0.048 ***	-0.181 *
Gender	Male	-0.054 ***	0.024 ***	0.023 ***	0.008 **	0.005
Employment status	Private	-0.012	0.021 **	-0.007	-0.001	-0.046
	Public	-0.011	0.023 *	-0.009	-0.002	-0.065
	Teacher	0.024	-0.036	0.012	-0.001	0.096
	Selfemployed	-0.025 *	0.013	0.005	0.007	0.047
	Parttime	-0.010	0.001	0.011	-0.001	-0.013
	House	-0.007	0.016	-0.008	-0.001	-0.033
	Student	-0.006	0.005	0.004	-0.003	-0.025
Education	Seniorhigh	0.040 **	-0.033 **	-0.002	-0.005	0.053
	Vocationalcollege	0.057 ***	-0.032 **	-0.015	-0.009	-0.002
	Juniorcollege	0.056 ***	-0.013	-0.027 *	-0.017 **	-0.058
	University	0.046 **	-0.021	-0.015	-0.010	-0.007
	Graduate	0.045 **	-0.013	-0.026	-0.006	0.009
Areas of residence	Hokkaido	0.007	0.006	-0.004	-0.009 **	-0.080 *
	Tohoku	0.034 ***	-0.003	-0.031 ***	0.000	-0.006
	Hokuriku	0.008	-0.004	-0.002	-0.002	-0.011
	Chubu	0.010	-0.004	-0.008	0.002	0.030
	Kinki	-0.004	-0.012 *	0.012 **	0.004	0.059 **
	Chugoku	0.012	0.005	-0.022 **	0.006	0.052
	Shikoku	-0.003	0.013	-0.015	0.005	0.023
	Kyushu	0.004	-0.007	0.002	0.001	0.021
	N				15517	1622
	Pseudo-R2				0.164	0.167
	LLR				-8111.8	-748.09

Table 9 Comparison with mobile payments via smart phone (marginal effects)

		Smartphone								Smartphone	
		Both no		Crypt only		Smartphone only		Both yes		within Crypto	
Financial literacy	Objective_financial_literacy	-0.015	***	0.001		0.011	***	0.003	*	0.016	
	News	-0.010	***	-0.001		0.006	***	0.005	***	0.031	***
	Fin_education_school	-0.034	***	0.017	***	0.004		0.013	***	0.021	
	Fin_education_home	0.008		-0.008	*	0.000		0.000		0.009	
	Fraud1	-0.077	***	0.023	***	0.038	***	0.002		0.018	
	Debt	-0.027	***	-0.012	***	0.028	***	0.006	***	0.006	
	Credit_card literacy	0.007		-0.016	***	0.019	***	-0.001		0.016	
Financial behavior	Myopia	-0.008	***	0.001		0.005	***	0.006	***	0.010	
	Herding	-0.014	***	0.006	***	0.002		-0.019	***	-0.090	***
	Self_control	0.012	***	-0.004	**	-0.007	**	0.007	*	0.066	**
	Over_confidence	-0.018	***	0.005	*	0.008	**	0.016	***	0.026	
	Loss_aversion	0.045	***	-0.010	***	-0.015	**	0.010	***	0.098	***
	Risk_aversion	-0.022	**	-0.003		0.018	*	-0.011	***	-0.005	
Information sources	S_fin	-0.013		0.015		-0.023	*	0.021	**	0.064	
	S_net	-0.062	***	0.030	***	0.015		0.018	**	0.061	
	S_fin_exp	-0.066	***	0.040	***	-0.004		0.030	***	0.068	
	S_fin_net	-0.024	*	0.011		0.002		0.011		0.046	
	S_other	-0.015		0.017		-0.017		0.015	*	0.074	
Investment experience	sif	-0.139	***	0.080	***	-0.002		0.061	***	0.095	***
	s_i	-0.049	***	0.043	***	-0.017	*	0.022	***	-0.039	
	s_f	-0.081	***	0.048	***	-0.008		0.041	***	0.082	
	i_f	-0.054	***	0.039	***	0.007		0.008		-0.114	
	s_only	-0.042	***	0.045	***	-0.021	**	0.019	***	-0.025	
	i_only	-0.033	**	0.006		0.014		0.013		0.041	
	f_only	-0.057	***	0.027	*	0.022		0.008		-0.081	
Pretax income	Income_0	0.049	*	0.018		-0.040		-0.027	**	-0.205	**
	Income_250_500	0.008		-0.016	**	0.008		0.001		0.063	
	Income_500_750	-0.006		-0.007		0.014		-0.001		0.034	
	Income_750_1000	-0.019		-0.011		0.029	**	0.001		0.060	
	Income_1000_1500	-0.053	***	0.001		0.045	***	0.006		0.081	
	Income_1500_	-0.102	***	0.011		0.070	***	0.021	**	0.163	**
	Income_NA	-0.001		-0.015		0.023	*	-0.006		0.031	
Financial assets	Asset_0	-0.017		0.003		0.016		-0.003		-0.018	
	Asset_250_500	0.010		-0.002		-0.006		-0.003		-0.031	
	Asset_500_750	-0.006		-0.002		0.002		0.006		0.038	
	Asset_750_1000	0.033	**	-0.013		-0.021		0.001		0.008	
	Asset_1000_2000	0.019		-0.011		-0.004		-0.004		0.016	
	Asset_2000_	0.052	***	-0.028	***	-0.013		-0.012	**	-0.018	
	Asset_NA	0.053	***	-0.025	***	-0.018	*	-0.010	*	-0.004	
Age	Age25_29	0.003		-0.003		0.011		-0.011	*	-0.038	
	Age30_34	0.038		-0.011		-0.010		-0.017	**	-0.050	
	Age35_39	0.032		-0.010		-0.001		-0.021	***	-0.072	
	Age40_44	0.082	***	-0.014		-0.037	*	-0.030	***	-0.097	*
	Age45_49	0.127	***	-0.025	*	-0.058	***	-0.044	***	-0.152	**
	Age50_54	0.142	***	-0.014		-0.069	***	-0.059	***	-0.266	***
	Age55_59	0.172	***	-0.021		-0.093	***	-0.058	***	-0.257	***
	Age60_64	0.223	***	-0.041	***	-0.109	***	-0.073	***	-0.273	***
	Age65_69	0.251	***	-0.041	***	-0.125	***	-0.086	***	-0.322	***
	Age70_74	0.335	***	-0.059	***	-0.186	***	-0.090	***	-0.301	***
	Age75_79	0.455	***	-0.032	*	-0.284	***	-0.138	***	-0.651	***
Gender	Male	-0.038	***	0.020	***	0.007		0.011	***	-0.011	
Employment status	Private	-0.030	**	0.017	**	0.011		0.001		-0.033	
	Public	0.003		0.011		-0.020		0.006		0.012	
	Teacher	0.049		-0.016		-0.015		-0.018		-0.023	
	Selfemployed	-0.037	**	0.017	*	0.019		0.001		-0.040	
	Parttime	-0.010		0.002		0.013		-0.005		-0.034	
	House	0.010		0.020	**	-0.022	*	-0.009		-0.115	*
	Student	0.019		0.001		-0.019		-0.001		0.009	
Education	Seniorhigh	0.022		-0.018		0.016		-0.019	**	-0.018	
	Vocationalcollege	0.034		-0.021		0.007		-0.020	*	-0.027	
	Juniorcollege	0.028		-0.004		0.002		-0.026	**	-0.105	
	University	0.031		-0.010		0.000		-0.020	**	-0.062	
	Graduate	0.032		-0.001		-0.013		-0.018	*	-0.054	
Areas of residence	Hokkaido	0.021		0.003		-0.020		-0.004		-0.038	
	Tohoku	0.017		-0.002		-0.013		-0.002		-0.007	
	Hokuriku	-0.004		0.003		0.010		-0.008		-0.072	
	Chubu	0.016		0.002		-0.014	*	-0.003		-0.013	
	Kinki	0.033	***	-0.004		-0.026	***	-0.004		-0.009	
	Chugoku	-0.004		0.006		-0.006		0.003		0.039	
	Shikoku	-0.003		0.018	**	-0.015		0.000		-0.047	
	Kyushu	0.003		0.002		0.003		-0.008	*	-0.046	
	N							15517		1622	
	Pseudo-R2							0.154		0.124	
	LLR							-10700		-956.88	

Appendix: Variables constructed from the FLS 2019

The FLS 2019 is a web survey that was administered to 25,000 individuals in Japan who were 18–79 years of age from March 1, 2019 to March 20, 2019. The FLS 2019 includes true/false questions on financial knowledge and financial decision-making skills, together with behavioral and attitudinal questions, as did the FLS 2016.

The FLS 2019 also includes the following questions on crypto assets, regarding whether or not respondents have adopted crypto assets during the past three years. Respondents who did adopt them are asked to choose their degree of understanding of crypto assets from among the following choices: understand very well; understand to some extent; do not understand so well; do not understand.

- Question 43: "Have you purchased the so-called crypto assets (virtual currency) during the past three years?" Choose one answer from the following options: 1. Yes; 2. No. "When doing so, how would you describe your understanding of the product details?" Choose one answer from the following options: 1. I understand the product details well enough to be able to explain them to other people; 2. I understand the product details to a certain extent; 3. I do not understand the product details so well; 4. I do not understand the product details.

If respondents have adopted crypto assets, they are asked about the profitability of their investment therein.

- Question 44: For those who selected yes in Question 43, "Did you make profits or have losses (including the cost of mining, purchase and sale, and capital gain or loss as of today) from your investment in crypto assets in the last three years?" Choose one answer from the following options: 1. I made a

profit; 2. Break even; 3. I made a loss.

The FLS 2019 also includes the following question regarding the adoption and usage of payment instruments.

- Question 45: “How often do you use the following payment methods: credit cards, debit cards, electronic money, mobile payments via smartphones, cash?” Choose only one answer from the following options: 1. Almost every day; 2. About once a week; 3. About once a month; 4. Scarcely or never; 5. Do not adopt it. Note that mobile payments via smartphones can be prepaid or post-paid, QR-code based, or in the form of mobile wallets for credit cards, debit cards, or electronic money. Cash includes checks.

We follow Sekita et al. (2018) and Kadoya and Kahn (2020) to construct variables for financial literacy and behavioral economics. First, per Sekita et al (2018), we define Objective financial literacy by the number of correct answers on 11 financial literacy questions from the survey: Question 18, Question 19, Question 21_3, Question 21_4, Question 25, Question 21_2, Question 30, Question 31, Question 22, Question 20 and Question 21_1. These questions pertain to five categories of financial literacy.

First, “deposits literacy” is defined as the number of correct answers on two relevant questions (Questions 18 and 19).

- Question 18: “Suppose you put 1 million yen into a savings account with a guaranteed interest rate of 2% per year. If no further deposits or withdrawals are made, how much would be in the account after 1 year once the interest payment is made? Disregard tax deductions. Answer with a whole number.”
- Question 19: “Then, how much would be in the account after 5 years? Disregard tax deductions.” Choose only one answer from the following

options: 1. More than 1.1 million yen; 2. Exactly 1.1 million yen; 3. Less than 1.1 million yen; 4. Impossible to tell from the information given; 5. Do not know.

Second, “risk literacy” is defined as the number of correct answers on two risk literacy questions (Questions 21_3 and 21_4).

- Question 21_3: “Please indicate whether you think the following statement is true or false: An investment with a high return is likely to be high risk.”
- Question 21_4: “Please indicate whether you think the following statement is true or false: Buying a single company’s stock usually provides a safer return than a stock mutual fund.”

Third, “insurance literacy” is defined as the number of correct answers on two insurance literacy questions (Questions 25 and 26).

- Question 25: “Which of the following statements on the basic function of insurance is appropriate?” Choose only one answer from the following options: 1. Insurance is effective when a risk occurs with high frequency, causing a large loss; 2. Insurance is effective when a risk occurs with low frequency, causing a large loss; 3. Insurance is effective when a risk occurs with high frequency, causing a small loss; 4. Insurance is effective when a risk occurs with low frequency, causing a small loss; 5. Don’t know.
- Question 26: “When a 50-year-old man reviews his life insurance policy (whole life insurance) after his children have become financially independent, which of the following statements is appropriate?” Suppose that other circumstances have not changed. Choose only one answer from the following options: 1. He should consider increasing the death benefit; 2. He should

consider decreasing the death benefit; 3. There is no need to review the policy, in particular; 4. Don't know.

Fourth, "debt literacy" is defined as the number of correct answers on four debt literacy questions (Questions 21_2, 30, 31, and 22).

- Question 21_2: "Please indicate whether you think the following statement is true or false: When compared, a 15-year mortgage typically requires higher monthly payments than a 30-year loan but the total interest paid over the life of the loan will be less."
- Question 30: "Which of the following statements on mortgages is appropriate?" Choose only one answer from the following options: 1. It is far less costly to continue living in a rented house for your entire life than to buy a house with a loan; 2. Mortgages can be repaid by either the equal payment method or the equal principal payment method but the total repayment is the same for both methods; 3. Mortgages are offered with either a floating interest rate or a fixed interest rate and those with a fixed interest rate are always more advantageous than those with a floating interest rate; 4. In order to decrease the total mortgage repayment, it is effective to prepare as much down payment as possible and make advanced repayments to the extent possible; 5. Don't know.
- Question 31: "Suppose you owe 100,000 yen on a loan and the interest rate you are charged is 20% per year, compounded annually. If you didn't pay anything off, at this interest rate, how many years would it take for the amount you owe to double?" Choose only one answer from the following options: 1. Less than 2 years; 2. At least 2 years but less than 5 years; 3. At least 5 years

but less than 10 years; 4. At least 10 years; 5. Don't know.

- Question 22: "If interest rates rise, what will typically happen to bond prices?" Choose only one answer from the following options: 1. They will rise; 2. They will fall; 3. They will stay the same; 4. There is no relationship between bond prices and the interest rate; 5. Don't know.

Fifth, "inflation literacy" is defined as the number of correct answers on two inflation literacy questions (Questions 20 and 21_1).

- Question 20: "Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?" Choose only one answer from the following options: 1. More than today; 2. Exactly the same; 3. Less than today; 4. Do not know.
- Question 21_1: "Please indicate whether you think the following statement is true or false: High inflation means that the cost of living is increasing rapidly."

In the end, we obtain Objective financial literacy from the number of correct answers on the 11 financial literacy questions above. In addition to Objective financial literacy, we measure a respondent's financial literacy using various other variables.

First, we use Question 53, which deals with how often a respondent acquires financial and economic information from mass media or the Internet, as used by Kadoya and Kahn (2020).

- Question 53: "How often do you acquire financial and economic information from sources such as newspapers, magazines, television, and the Internet?" Choose only one answer from the following options: 1. Almost every day; 2. About once a week; 3. About once a month; 4. Less often than the above; 5.

Never; 6. Other.

We construct the variable *News* as the difference between 5 and the number of option chosen as the answer to Question 53. *News* takes on higher values for those who frequently acquire financial and economic information from sources like newspapers, magazines, television, and the Internet. We expect a respondent with a higher value for *News* to have rich information on financial and economic conditions and, thus, higher financial literacy.

Second, we use Question 39 to ask respondents about their experience of financial education at school.

- Question 39: "Was financial education offered by a school or college you attended, or a workplace at which you were employed?" Choose only one answer from the following options: 1. Yes, but I did not participate in the financial education offered; 2. Yes, and I did participate in the financial education; 3. No; 4. Don't know.

We define the variable *Fin_education_school* as 1 for a respondent who chooses option 2 for the response to Question 39, otherwise we define it as zero. We expect that a person who has experienced financial education at school would have a higher level of financial literacy.

Third, we use Question 40, which asks respondents about their experience of financial education in the household.

- Question 40: "Did your parents or guardians teach you how to manage your finances?" Choose only one answer from the following options: 1. Yes; 2. No; 3. Don't know.

We define the variable *Fin_education_home* as 1 for a respondent who chooses option 1

as their response to Question 40, otherwise we define it as zero. We expect that a person who has experienced financial education at home would have a higher level of financial literacy.

Fourth, we use Question 52 to ask respondents about their financial trouble experiences, as Kadoya and Kahn (2020) did.

- Question 52: "Have you ever been involved in financial trouble, such as bank transfer fraud or multiple debts?" Choose only one answer from the following options: 1. Yes; 2. No.

We define the variable *Fraud1* as 1 for a respondent who chooses option 1 as their response to Question 52, otherwise we define it as zero. We expect that a person who has no experience of financial trouble would have a higher financial literacy.

Fifth, we use Question 5 to ask respondents about their knowledge of family budgeting and credit cards.

- Question 5: "Which of the following statements on family budget management and credit cards is inappropriate?" Choose only one answer from the following options: 1. Using credit cards in a well-planned manner according to income; 2. Any unsettled credit card payment is practically a debt; 3. A credit card fee (interest) is charged for revolving payments but not for installment payments; 4. Failure to pay the credit card charge may cause credit card transactions to be declined; 5. Don't know.

We define *Credit card literacy* at a value of 1 for those who choose 3 as their response, otherwise we define it as zero. We expect that a person who has better knowledge of family budgeting and credit cards would have a higher level of financial literacy.

Sixth, we use Question 35 to construct variables that indicate a respondent's

sources of knowledge and information on finance.

- Question 35: “At what opportunities do you mainly acquire knowledge or information when you choose financial products? ‘Financial products’ are deposits at financial institutions, securities, insurance policies, etc.” Choose up to three answers from the following options: 1. Consultation at financial institutions (asking the sales staff to explain); 2. From pamphlets provided at financial institutions; 3. At a lecture meeting or a seminar; 4. Consultation with financial professionals/professional financial advisors; 5. Through media reports (TV and radio programs, newspapers, magazines, etc.); 6. From websites; 7. Conversations with family members/friends; 8. By taking classes and/or attending lectures at schools (including those for adults); 9. Other information sources; 10. I’m not sure what opportunities would allow me to acquire such knowledge or information; 11. I don’t invest in financial products.

After reviewing all combinations of choices, we first add choices 1 and 2 as households relying on financial institutions. Then, we classify the responses into seven groups. The first group comprises respondents who choose 11 exclusively. The second group comprises respondents who choose 10 exclusively. We construct the dummy variable *S_dont_know*, which takes 1 for these respondents and is otherwise zero. The third group comprises respondents who choose 1 and/or 2 exclusively. We construct the dummy variable *S_fin*, which takes 1 for these respondents and is otherwise zero because these respondents receive their information from financial institutions. The fourth group comprises respondents who answer 6 exclusively. We construct the dummy variable *S_net,* which takes 1 for these respondents and is otherwise zero because these respondents

receive information from the Internet. The fifth group comprises respondents who choose 3 and/or 4. We construct the dummy variable *S_fin_exp,* which takes 1 for these respondents and is otherwise zero because these respondents receive information from financial experts. The sixth group comprises respondents who choose 1 and/or 2 and 6. We construct the dummy variable *S_fin_net*, which takes 1 for these respondents and is otherwise zero because these respondents receive information from financial institutions and websites. The seventh group comprises the rest of the respondents. We construct the dummy variable *S_other,* which takes 1 for these respondents and is otherwise zero.

Seventh, we use Question 34 to construct dummy variables showing a respondent's investment participation in three risky financial assets: stocks, investment trusts, and foreign currency denominated deposits and MMFs.

- Question 34: "Have you ever purchased any of the following financial products: Stocks, investment trusts, and foreign currency denominated deposits and MMFs?" Choose one answer from the following options: 1. I have purchased them; 2. I have never purchased them.

We construct the dummy variables *sif*, *s_i*, *s_f*, *i_f*, *s_only*, *i_only*, and *f_only*, which take 1 and are otherwise zero for those who have purchased the three financial products or combinations thereof—stocks and investment trusts, stocks and foreign currency denominated deposits and MMFs, investment trusts and foreign currency denominated deposits and MMFs, stocks only, investment trusts only, and foreign currency denominated deposits and MMFs only.

Behavioral economists argue that a person's financial behavior varies despite having the correct information or knowledge (see Beshears et al., 2018, for literature on behavioral household finance). Hence, we construct the following six variables for

behavioral economics, as did Sekita et al. (2018).

First, the variable *Myopia* is based on Question 1_10 of the FLS, which asks respondents to answer the following:

- Question 1_10: “How much do you agree or disagree that the following statement applies to you personally? Choose on a scale of 1 to 5, where 1 means ‘agree’ and 5 means ‘disagree’: If I had the choice of (1) receiving 100,000 yen now or (2) receiving 110,000 yen in 1 year, I would choose (1), provided that I can definitely receive the money.”

The key idea behind *Myopia* is to capture present-biased preferences in which one places extra value on more immediate awards. We define the variable *Myopia* as the difference between 5 and the number of the scale chosen as the answer to Question 1_10, so that a higher value is associated with a greater degree of myopia.

Second, the variable *Herding* is based on Question 1_3 and captures the notion that a person prefers to follow others when making financial decisions rather than to make independent ones.

- Question 1_3: “How much do you agree or disagree that the following statement applies to you personally? Choose on a scale of 1 to 5, where 1 means ‘agree’ and 5 means ‘disagree’: When there are several similar products, I tend to buy what is recommended as the most selling product, rather than what I actually think is a good product.”

We define the variable *Herding* as the difference between 5 and the number of the scale chosen as the answer to Question 1_3, so that a higher value reflects a greater degree of herd-like behavior.

Third, the variable *Self-control* is based on Question 1_1 and represents a proxy

of the degree to which a person makes deliberate and well-thought-out decisions rather than deciding impulsively.

- Question 1_1: "How much do you agree or disagree that the following statement applies to you personally? Choose on a scale of 1 to 5, where 1 means 'agree' and 5 means 'disagree': Before I buy something I carefully consider whether I can afford it."

Our measure of *Self-control* is defined as the difference between 5 and the number of the scale chosen as the answer to Question 1_1, so that a higher value reflects a lower tendency toward impulsive spending and, hence, a higher degree of self-control.

Fourth, we measure the variable *Over-confidence* as the difference between *Subjective financial literacy* and *Objective financial literacy*. Our measure of *Subjective financial literacy* is based on Question 17.

- Question 17: "How would you rate your overall knowledge about financial matters in comparison with other people?" Choose only one answer from the following options: 1. Very high; 2. Quite high; 3. About average; 4. Quite low; 5. Very low; 6. Don't know.

We define *Subjective financial literacy* as the difference between 5 and the number of the option chosen as the answer to Question 17, so that a higher value corresponds to a higher level of *Subjective financial literacy*. *Objective financial literacy* is defined as the sum of the five sub-categories of financial literacy defined earlier. A high value on the *Over-confidence* variable reflects that there is a large gap between a respondent's perception of their own financial literacy and their actual level of financial literacy, showing a greater degree of over-confidence.

Fifth, we measure the variable *Loss aversion* based on Question 6.

- Question 6: “Suppose that, if you invested 100,000 yen, you would either get a capital gain of 20,000 yen or a capital loss of 10,000 yen at 50% probability. What would you do?” Choose only one answer from the following options: 1. I would invest; 2. I would not invest.

We define *Loss aversion* as a dummy variable that takes the value of 1 if the respondent chooses option 2 for the question above and the value of zero otherwise.

Sixth, we also create a measure of *Risk aversion* using Question 1_9.

- Question 1_9: “How much do you agree or disagree that the following statement applies to you personally? Choose on a scale of 1 to 5, where 1 means ‘agree’ and 5 means ‘disagree’: I am prepared to take a risk when saving or making an investment.”

We define *Risk aversion* as the number of the scale chosen as the answer to the question above minus 1, so that a higher value is associated with a higher degree of risk aversion.

In addition to information on financial literacy, the FLS provides the following demographic variables: household annual pretax income by ranges (*Income*); household total financial asset holdings by ranges (*Asset*); gender (*Male*); age; employment status (*Private, Public, Teacher, Self-employed, Part-time, House, Student*); educational attainment (*Senior high, Vocational college, Junior college, University, Graduate*); area of residence; and whether the respondent household has any loans (*Debt*).